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Setting up and Coordinating Scripts in AutoCAD for Presentations, Teaching, and Learning Related to Technical Graphics

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***Abstract* - This article introduces an additional tool for AutoCAD to create and present slides with highly effective scripts, aiding in presentations, teaching, and learning related to technical graphics. A simple language has been developed for scripting. This language includes many powerful programming statements to leverage the drawing and viewing capabilities using AutoCAD.**

Keywords: Technical graphics, AutoCAD, drawing, slide, script, animation.

I. GENERAL INTRODUCTION

Courses related to descriptive geometry, technical drawing, and both 2D and 3D geometric modeling are indispensable in many engineering training programs at universities. With the current demand for E-learning, it is essential to have software that assists in presenting these contents, not only in the classroom but also for self-study and the work of technical staff. There is a wide variety of presentation software available, which helps to present slides with dynamic scenes ([1, 2, 3, 4, 5]). Some software even allows manual operations such as writing and drawing in real-time. However, when using various presentation software programs, users can potentially encounter certain difficulties in the following tasks:

- Creating a series of slides and presenting animations that incorporate a variety of 2D and 3D objects, diverse 2D and 3D transformations, and operations for observing in three-dimensional space, zooming, and moving the view area.
- During discussions or self-study, it is sometimes necessary to perform additional precise geometric constructions and flexible 2D and 3D observation operations directly on the slide being viewed.

To overcome these, it might be possible to combine multiple software to leverage their individual strengths ([3]), but there are still the following difficulties:

- Converting diverse 2D and 3D graphic objects into a compatible type for use in presentation software is time-consuming, labor-intensive, and results in the loss of many capabilities related to observation, modeling, and animation creation.
- If you choose to use multiple software programs that handle different types of objects simultaneously, it becomes challenging to integrate these objects into the same scene with all the necessary movements and transformations, andto maintain the required observation and control capabilities.

This article will present an alternative solution, which is to create a “hybrid” software that combines many capabilities of both presentation software and 2D, and 3D design software. The main features of this software are:

- The software is written in VBA (Visual Basic for Applications) and can be saved as a project file containing macros and additional command definitions. It operates in the AutoCAD environment, utilizing AutoCAD objects and external reference objects.
- Additional tools written for AutoCAD assist in creating and editing slides. Each slide can contain one or more scripts. Scripts are executed when presenting a slide and also during subsequent discussions and interactions.
- Tools for editing scripts, selecting participating objects, and choosing object actions. A language with simple syntax has been developed for writing scripts, including comments, loops, subroutines, and multiple script statements for applying to objects in the script. Each such command replaces long and complex program segments if written in Autolisp, VBA, or C++.
- There are many commands to manage slides, present a selected slide, execute a script, jump to another slide with a certain step of sequence number, return to the first slide, go to the last slide, review the previously presented slide, list all slides in thumbnail form, and from there, zoom in and out to view and select a slide for presentation.

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- Users can control, to a certain extent, the process of executing a script, such as pausing, exiting, reversing the direction of execution, and performing additional view commands.
- After displaying a slide, users can draw interactively, understood here as writing and constructing additional figures on the slide and performing 2D and 3D view commands depending on the discussion process.
- Development potential: During the teaching and learning process, users can draw and write on the slides, then save and edit the content as necessary to continuously refine it. It is possible to distribute presentation document files for self-study, view content, run scripts, do exercises, solve them, and view answers. It is possible to export slides into an electronic book in PDF format or to record the screen to create videos and animated films for education, communication, and entertainment. To exploit the rich capabilities of AutoCAD, more new script statements can be written in the future to meet specific work requirements.

II. OPERATIONS AND ADDITIONAL COMMANDS FOR AUTOCAD TO CREATE SLIDES AND SCRIPTS

2.1 Layers Used for Each Slide

In an AutoCAD document file with the "*.dwg" extension, the slides' objects are distributed in separate areas in 2D or 3D space. Generally, each slide uses different layers. Additionally, there are global layers used commonly across slides.

2.1.1 Global Layers, Shared across Slides

Layers are named with a string of characters starting with "%GL". When displaying a slide, these layers are always turned on and thawed.

2.1.2 Layers specific to each slide (hereafter referred to as individual layers)

Each slide has one or more dedicated layers. The name of each layer is a string of characters that starts with '%TH', '%EX', or '%AN', in either uppercase or lowercase. The characters that follow specify a positive integer i such as 1, 2, 3, etc., and there may be additional characters afterwards if desired. These layers contain the content of the slide numbered i, belonging to categories theory, exercises, answers, or whatever category intended by the creator. A single file can contain all three systems of slides, and one can switch from displaying one system to another using the commands /TH, /EX, /AN entered on the AutoCAD command line. After switching, the first slide will be displayed. For example, the list of layer names could be: "%GL", "%TH1", "%TH1.SC", "%TH2", "%TH2.SC", "%TH3", "%TH3.SC", "%TH4", "%TH4.SC", "0". (In this list, each name is placed between two quotation marks). The layer "%TH1.SC" contains an Mtext object explained in Section 2.1.3.

The individual layers of a slide are turned on and thawed when presenting that slide and are turned off and frozen when presenting another slide. Layers are automatically locked once a slide has been displayed to prevent unintended content deletion.

Note: In Sections 2.1.2, 2.2, and Section 4, some commands added to AutoCAD are described. These command names start with a slash (/). With such a characteristic, these command names can be easily searched for input into the command line thanks to AutoCAD's AutoComplete function. The Slash key is conveniently located near the Enter key on the QWERTY keyboard, making it quite handy.

2.1.3 Objects containing scripts

Each script is written in an Mtext object, placed on a layer of the slide. A slide can have multiple scripts. If that Mtext object is placed on a layer where, after the slide number in the layer's name, there is only the string ".SC" (in uppercase or lowercase), the script will be executed immediately upon presenting that slide (hereinafter referred to as “the opening script” of the slide). Then, on this slide, during the explanation and discussion process, if an Mtext containing a script is selected and the command /E is entered on the command line, that script will be executed (see Section 4.5). The Mtext can be minimized so as not to affect other content or edited in color and font size appropriately to create a command button, which is selected and executed with the /E command. Scripts can also contain commands to switch to another slide.

2.1.4 Objects participating in the script

If named in a script statement, the object must be of the block reference type and belong to the individual layers of the slide. The software will create a copy of the object to participate in the scene and hide the original object to preserve its position and size. The name of the block reference (name property) will be written in the script according to a predefined syntax. Do not use two objects with the same name to participate in a script. In general, before executing the script, the participating objects will be automatically hidden and then displayed according to the script commands.

During the drawing editing process, quite small objects scattered around may be mistakenly placed from the individual layer of one slide to that of another, and if they are “packaged” within a block, this may cause errors when displaying the slide and disrupt the script. Therefore, block

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references participating in the script should only contain objects belonging to the global layers. If violated, the /CB command (used to create a block reference placed on a slide's own layer, Section 2.2.2) will report an error. Even if a slide does not have a script, the block references created with the /CB command will still avoid the aforementioned error.

2.1.5 Example of Script Content

The syntax of the statements will be detailed further in Section 3. Below is the source code of a script illustrating the process of creating a section view. Figure 1 shows images at two points in time during the execution of that script.

```
`` Illustrating the section view creation process.
`` Declare the default values for the duration and the number
`` of frames for an animation.
DE 600 24;
`` Choose the viewpoint and visual display style.
CL -Vpoint -1,-1,1 VS R;
`` The program displays the border and zooms to appropriately
`` fit the entire border.
Border ^ SH.;  CL Z E;
`` The program waits for the appropriate key press.
`` At this moment, the user can adjust the additional zoom
`` if desired.
 W;
`` The solid appears and gradually enlarges
`` to the correct size, then the program waits for
`` the appropriate key press.
Solid ^ SC;  W;
`` The program displays the cutting plane and then waits for
`` the appropriate key press to continue.
Cutting Plane ^ SH.;  W;
`` The program displays the two parts created after the cut
``and hide the original solid.
Part 1, Part 2 ^ SH.;
Solid ^ HI.;
`` The program moves part 1 aside and then waits for
`` the appropriate key press to continue.
Part 1 ^ LTR;  W;
`` The projection plane and the arrow indicating the projection
`` direction appear.
Projection Plane, Arrow ^ SH.;  W;
`` The projection rays are drawn sequentially.
Projection Rays ^ SDS.;  W;
`` The program displays the section view and then waits for
`` the appropriate key press.
Section View ^ SH.;  W;
```

2.2 Additional Commands for Creating Slides and Scripts

2.2.1 The /IN Command (to insert additional slides)

If the current layer belongs to a slide numbered i, this command will increase the index of each slide by 1, starting from the current slide, and correspondingly rename the layers. Thus, slide number i will become slide number (i+1). A new layer for the new slide number i will then be created. Entering the /IN command on the AutoCAD command line and pressing Enter repeatedly will create a series of new slide indices.

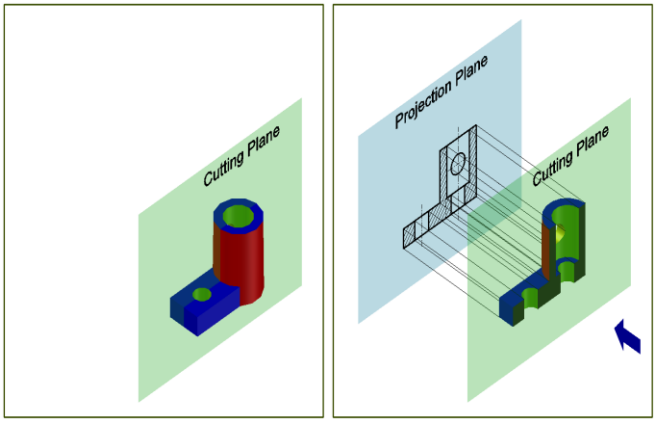

Figure 1: Images corresponding to two moments in the script execution process

2.2.2 The /CB Command (to create a block reference placed on a private layer of a slide)

In AutoCAD, after selecting a number of suitable objects from the global layers, then entering the /CB command, and choosing an insertion base point, a new block containing these objects is created, and a block reference is placed on the current layer of the current slide. The block's name is copied to the clipboard so that the user can immediately paste it into the script being written. The block name is automatically set, starting with an apostrophe ('), followed by a string of characters corresponding to a positive integer (e.g., '1, '2, ...) chosen from among the block names not yet used or without a block reference in the drawing file. Later, users can use AutoCAD's REN command to change it to another, more memorable name if desired.

2.2.3 The /CP Command (to create a block reference as a path object for use with the motion along path command in Section 3.7.9)

The user can draw a Spline λ to outline a path, then use AutoCAD's Divide command to create division points that segment λ into N equal arc length sections. Next, select λ and the division points, and enter the command /CP to generate a 3D Polyline ζ and create a block reference containing ζ.

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III. SCRIPT SYNTAX AND THE STATEMENTS EXECUTED WITHIN THE SCRIPT

Animations occurring during the presentation are described using a scripting language, which can be executed without being compiled into a binary file. This document created is referred to as a "script".

3.1 Statements, Constants, Statement Names, Object Names, Subroutine Names

The script consists of statements and annotations. Statements are separated from each other by a semicolon (;). A long statement can be written on multiple lines so that no names or constants are split by a line break. If the script contains a string of two grave accent (`) characters in succession, then the text from that string to the end of the line is considered a comment and does not belong to the statements. In statements, uppercase and lowercase letters are considered the same. The constants used in the script include long integers and double-precision floating-point numbers, with the format as in the VBA language. The objects participating in the script are block references. The object name is also the name of that block reference. This name must comply with AutoCAD regulations and may contain spaces (blank). Moreover, the name cannot contain the circumflex (^) character. Subroutine names cannot contain the following characters: space (blank), comma (,), semicolon (;), grave accent (`), circumflex (^), double quote ("), apostrophe ('), ampersand (&).

3.2 General Syntax of a Statement

[<Object Name List>] ^<Statement name>
[<Parameter List>];

The parts within square brackets [...] are optional, depending on the specific case. The <Object Name List> consists of block reference names separated by commas (,). The <Parameter List> consists of parameters separated by at least one space. A parameter can be a constant, character, or object name. If a name contains spaces, then it must be enclosed in double quotes. Some parameters are allowed to receive default values. In such cases, they are indicated by the & (ampersand) character, such as the T and F parameters described at the end of Section 3.2. However, if no other parameters are written after the & character, it may be omitted.

A script statement can be used to declare or control the flow of a program's execution but is also used to perform a specific task.

When executing the script, the program will ignore the comments, then examine the statements and process them. To find the processing procedure faster, the statements are grouped by whether they have an object set or not and by the characteristics of the statement name (for example, statement names ending with a dot "."). Many script statements essentially function as procedures that have been pre-programmed according to appropriate algorithms to affect objects such as documents, layers, blockrefs, mtexts, 3dpolylines... (within the AutoCAD object model) through properties like color, visible, insertion point, count... and object methods such as add, delete, move, rotate3d... The statements for creating translational movement use the move method, statements for creating rotational movement around an axis use the rotate3d method, and statements that involve homothety transformation use the scaleentity method. Many animation statements simulate motion by sequentially displaying frames during the animation period. These statements require the T and F parameters.

T is the duration of the animation (the time period over which the animation occurs), an integer measured in milliseconds.

F is the number of frames in the animation.

When simulating a transformation process over a period of time, it is assumed that the rate of change of the distance traveled (in translation), the rotation angle (in rotational transformation), and the homothetic coefficient (in homothety transformation) is constant (when not considering the computer's calculation time). At the level of serving presentations, before each frame is displayed, the software actively creates a waiting period (measured in milliseconds) by the integer-rounded value of (T/F). Thus, the declared value of T is approximate, not considering the calculation time to obtain a frame on each specific computer. To be more accurate, first use the following script segment:

CL DATE;
<Animation Statement>
CL DATE;

By using AutoCAD's DATE Express Tool in this manner, it's possible to read the approximate start and end points in time of the animation statement on the AutoCAD Text Window by the system clock. From there, the actual duration can be estimated, and the declared T value adjusted to achieve the desired actual duration, provided that T remains non-negative.

3.3 Loops

LOOP [<Number of iterations>];

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<Statement block>
EL;

If the number of iterations is not specified, the loop must include a KEL command to detect the appropriate keystroke and stop the iteration process (see Section 3.8.5).

3.4. Subroutines

The software allows for the definition of a procedure that does not return a value and does not require input parameters in the following manner:

SUB <procedure name>;
<Block of statements>
ES;

The code block to define a procedure must be placed after the main program code block or after the definition of another procedure.

To call the procedure, use the statement:

CALL <procedure name>;

3.5 Simulating Parallel Processes

Loops can be used to create the impression that processes are happening almost "in parallel". Each iteration only executes a part of each process. After m iterations, all processes are completed. This method can be applied with statements like BL, S_, R_, T_ (see Section 3.7). The duration of each process in one iteration should be quite short to create the necessary impression.

LOOP m;
<Part of process 1>
<Part of process 2>
…
EL;

3.6 Script Execution Direction

Scripts are executed in a forward direction from one statement to the next and move control as required by loops or subroutine calls. At the appropriate time, the proper key can be pressed to reverse the execution direction (see Section 3.8.3). Then, a statement block within a loop or subroutine is also reversed in the execution direction.

In Section 3, a statement is considered reversible if it returns objects to their original state when the execution direction is reversed. In Sections 3.7 and 3.8, statements will be described as they are executed in a forward direction. Statements that hide or show a set of objects and statements that simulate motion and transformation are reversible. The remaining statements are not reversible because they will execute the same in both directions or do nothing in one of the directions. There are cases where it is possible to pair statements to create reversibility.

3.7 The Statements That Require a List of Objects

3.7.1 Introduction

The functionality of these statements is quite diverse. There are statements for defining the drawing area using two objects (the LIM. statement), creating a user coordinate system with three objects (the UCS. statement), and hiding or showing objects (the HI., SH. statements). Additionally, there are statements for separately displaying sets of objects (IS), zooming in on an object set using AutoCAD's Zoom command with the Object option (ZO), sequentially displaying each component object of a block reference in its correct size (SD.) or gradually increasing to the correct size (SDS.). Some other functionalities are making a set of objects blink a number of times (using the BL statement), transforming a set of objects through a homothety transformation (S_) or a rotational transformation around a specified axis (R_), creating motion along a path (T_), and making a set of objects appear and move to a location within the display area through translational transformation, homothety, and rotation around the X, Y, Z axes (using statements such as TL, TR, SC, SCD, TLRY, TRRY, RX, RY...). Additionally, it is possible to move a set of objects off the display screen through transformations (using statements LTR, LTRRY, LTL, LTLRY)...

In Section 3.7, if a statement name does not have a period (dot) (.) at the end, then executing that statement on a set with more than one object, in order to perform the animation corresponding to that statement, the program will create a block reference containing all the objects in the set and make this block reference move and transform. Specific parameters are required depending on the statement. Below is a more detailed description of some statements.

3.7.2 The Statements SH., HI

Purpose: To show or hide objects in a list.

3.7.3 The Statements SD. and SDS

<Object name> SD. [T] [F];
<Object name> SDS. [T] [F];

Specifically, with the SDS. statement, the object declared in the statement is a block reference containing component block references. Each component object will appear and increase to its correct size through a homothety transformation

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with the insertion point of each component object as the center.

3.7.4 The Statements SC and SCD

The object set will appear and increase (with SC) or decrease (with SCD) to its correct size through a homothety transformation with the insertion point of the first object in the list as the center.

3.7.5 The Statements for Making a Set of Objects Appear and Move into Position

- Statement TL
  The set of objects appears so that the insertion point C of the first object in the list coincides with the upper-left corner of the drawing area on the (X, Y) plane (considered with the origin coordinate system of AutoCAD), and then it will move in a translational motion so that the trajectory of C is a straight segment connecting its initial position to its final correct position.
- Similarly, there is a statement TR where the starting position of C is at the upper right corner of the drawing area.
- With the TLRY statement, the set of objects undergoes a combination of two motions: translational as in statement TL and rotating around an axis through C, parallel to the Y-axis of the origin coordinate system. An additional parameter is the number of rotations.
- Similarly, there are statements TLRZ, TLRX, TRRX, TRRY, TRRZ.
- Statements RX, RY, QZ
  The set of objects appears with the insertion point at the correct position but rotates a number of times around an axis through C and parallel to the X or Y or Z axis, then stops.

3.7.6 The Statements for Making Objects Move Off the Display Screen

- Statement LTR: Similar to TR, but the set of objects moves in the opposite direction and disappears.
- Statement LTRRY: Similar to TRRY, but the set of objects translates in the opposite direction and disappears.
- There are also statements LTL and LTLRY.

3.7.7 The S_ Statement for Creating an Animation Simulating a Homothety Transformation

<Object name list> ^ S_
<The name of the object used to determine the center of homothety transformation >[k] [T] [F] [S] ;

- The homothetic coefficient k is a real number.
- The center of homothety is the insertion point of the object determining the center.
- If S = 1, the animation will occur "silently", the objects will be transformed but not displayed, even in their final position.
  If S = 0 (default), the objects will be displayed during the animation.

3.7.8 The R_ Statement for Creating an Animation of Rotation Around an Axis

<Object Name List> ^ R_ β<Rotation Angle> [T] [F] [S];
β is the name of a block reference containing a line object used as the rotation axis.
The rotation angle is a real constant, measured in degrees.
S has the same meaning as in 3.7.7.

Note: There is also the RP_ statement, which has syntax and function similar to the R_ statement. The difference is that although β is the name of a block reference containing a line object, the axis of rotation will pass through the insertion point of the object named at the top of the object name list and will be parallel to that line object.

3.7.9 The T_ Statement for Moving an Object in Translation along a Path

<Object Name List> ^ T_ <Path Name>
[T] [F] [L] [R] [S];

- The path is a block reference containing a 3D Polyline object ζ, either open or closed, consisting of N straight segments. The path is created by the /CP command (see Section 2.2.3).
- The insertion point C of the first object in the list may already coincide with a vertex of ζ; if not, it will be translated to the position of the first vertex of ζbefore starting to follow the path.
- S has the same meaning as in 3.7.7.
- The R parameter defaults to 0. In this case, point C moves in the forward direction (according to the order in the list of vertices of ζ). If R = 1, then point C moves in the reverse direction.
- The L parameter defaults to 0. In this case, the set of objects moves so that over the period T, point C jumps F steps, in each step crossing over (N / F) segments. Eventually, point C anchors at a vertex of ζ. It is necessary to adjust N to be divisible by F.
  The L parameter is set to 1 when the T_ statement is placed in a loop, and in each iteration, point C jumps F steps, in each step jumping over N/(m.F) segments on ζ. Here, m is

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the number of loops predefined by the LOOP statement. It is necessary to choose N divisible by (m.F).

3.8 The Statements Not Requiring an Object Name List

General Syntax:
<Statement Name> [Parameter Sequence];

3.8.1 The DE Statement

DE T F;

Purpose: To redefine the default values of T (duration) and F (number of frames) for subsequent animation statements executed in the forward direction.

There is also the DE- statement, similar in function, but its declaration only takes effect when executed in the reverse direction.

3.8.2 The CL Statement (to execute an AutoCAD command)

CL <Command Name 1><Parameter List 1>
[<Command Name 2><Parameter List 2>] …;

The command names are full names or abbreviations as specified in AutoCAD, including names of additional commands that have been defined (see Section 2.2 and Section 4).

Example:
CL -Vpoint 1, -1, 1 Z E;

Parameters are listed in the order they are entered on the AutoCAD command line. A press of the Enter key or Space on the command line is represented by one or more consecutive spaces in the parameter sequence. If the Enter key or Space is pressed multiple times in succession, the first press is indicated by a space, and each subsequent press by an & followed by a space. Spaces before the semicolon at the end of a script statement can be omitted.

3.8.3 The W Statement (no parameters required)

Purpose: To pause the process, waiting to receive a suitable key press to respond accordingly. Specific responses are as follows:

- PgDn: Continues script execution in the forward direction.
- PgUp: Continues script execution in the reverse direction.
- TAB: Exits from the script execution process.
- Home: Executes AutoCAD's Zoom command with command line parameter 0.91x, then waits for another key press.
- End: Executes the Zoom command with command line parameter 1.1x, then waits for another key press.
- Shift: Executes AutoCAD's Zoom command as when entering the command on the command line. At this point in time, the mouse wheel can be used to zoom in or out of the display, or the mouse can be used to select two points for a rectangular window on the screen, which will be zoomed to as large as possible. Holding the left mouse button and moving the mouse can pan the viewing area. The user can press the ESC key to terminate the Zoom command or enter options and input data as requested on the command line until the command concludes. Afterward, the cursor related to the Zoom command disappears, and the program waits to receive another key press.
- Ctrl: Executes AutoCAD's Regen command.
- Insert: Toggles the current state of hiding or showing the AutoCAD viewcube on the screen, then the program waits for another key press. The mouse can be used to actively change the viewing direction by interacting with the viewcube.

3.8.4 The KEL Statement (no parameters required)

This statement is placed in a loop and is designed to receive key press actions and process them appropriately.

- PgDn: Exits the loop and continues script execution in the forward direction.
- PgUp: Exits the loop and continues script execution in the reverse direction, from the statement above the LOOP.
- Responses to other keys are the same as for the W statement.

3.8.5 The HE Statement (no parameters required)

Purpose: To halt and exit the script execution process. This statement assists in running script segments and debugging.

3.8.6 The Other Statements

There are many other statements with a variety of functions, such as playing a wav format audio file (using a Windows API function), determining the viewing direction in the current viewport, pausing the process for a period of time, etc.

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IV. COMMANDS FOR SLIDE PRESENTATION, SCRIPT EXECUTION, AND INTERACTIVE DRAWING

4.1 Introduction

These commands have been added to AutoCAD and can be entered on the command line. Generally, when presenting a slide, the software will interact with AutoCAD to perform the following steps:

1) Freeze and turn off all the layers specific to other slides.
2) Turn on and thaw the global layers and the layers specific to the slide being presented.
3) Lock all layers.
4) Set the default initial viewing direction as opposite to the Z axis, and set the visual style to 2D wireframe.
5) Hide the ribbon, toolbars, menu bar, status bar, model tab, layout tabs, and view cube to increase the display area for the slides.
6) Hide the objects participating in the opening script of the slide (if any).
7) Execute AutoCAD's Zoom command with the Extents option.
8) Execute the opening script of the slide (if any).

4.2 The Commands /F, /H, /P, /N

Purpose: To present the first slide, the last slide (the slide with the highest ordinal number), the slide immediately before the current slide, and the slide immediately after the current slide.

4.3 The /NU Command

Purpose: To go to the slide with a specified ordinal number, which will be entered on the command line.

Note for Sections 4.2and 4.3:

In [6], slide-specific layers similar to those in Section 2.1 are used, along with commands that have functions similar to /F, /H, /P, /N, /NU, /TH, /EX, but there is no creation or execution of scripts, no creation of block references that are placed in slides and participate in scripts, and no creation of global layers to contain objects within those block references.

Therefore, the composition of objects in the layers and the operation of commands in [6] have distinctive and simpler characteristics compared to those in this paper.

4.4 The /L Command (to list slides) and the /S Command (to go to a selected slide)

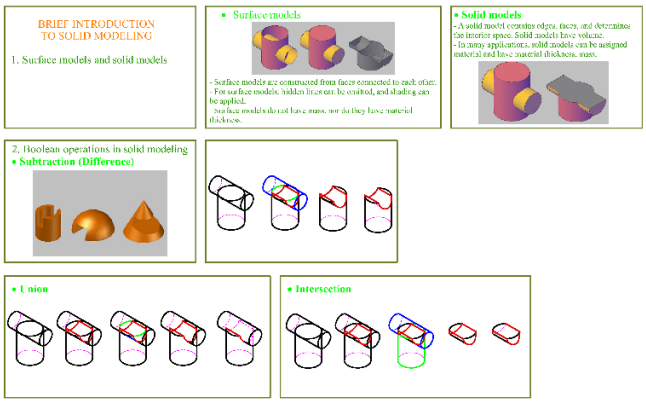

Figure 2: Display of all slides together as scaled-down versions that collectively fit the screen

The /L command displays all slides together as scaled-down versions that collectively fit the screen, following a similar process as outlined in Section 4.1. However, it differs in that it requires displaying all slides instead of just one, and it does not perform steps 1, 6, and 8.Users can view and manipulate further with AutoCAD's zoom and pan commands. Users can then select one or several objects on the desired slide and enter the /S command to display that slide.

4.5 The /ECommand

- Purpose: To execute the script written in the Mtext object selected by the user.
- The software will search for the slide containing that Mtext and then act as if it were presenting a slide, with a few differences or additional points to note:
  - It will execute the script within the Mtext, which does not necessarily have to be the opening script of the slide.
  - Before executing that script, it will hide the objects participating in the script and will not change the viewpoint, zoom level, and the current visual style.
- Error messages: Generally, when executing a script using the /E command or when executing the opening script upon displaying a slide, if the program detects syntax errors or runtime errors, the script will be stopped, and a dialog box will appear, providing details about the characteristics of the error, including the sequence number of the command that generated the error (if applicable).

4.6 The Other Commands

To display slides, there are also commands that allow users to jump back to the slide immediately presented before the current slide, or advance to a slide according to a sequence number step, which can be either positive or negative, as specified on the command line. To assist in viewing, interface screen management, layer management, to facilitate

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discussion, and interactive drawing, there are also AutoCAD commands and additional commands to toggle the visibility of the menu bar, status bar, view cube, model tab, layout tab, commands to unlock all layers, and thaw all layers…

V. DISCUSSION AND CONCLUSION

The software has been created and features general characteristics as outlined in Section 1.More detailed descriptions of its capabilities and usage instructions are provided in Sections 2, 3, and 4.

The software introduced above can be effectively used for teaching and learning technical graphics, especially in online education settings. It allows users to control presentations flexibly and to draw supplementary objects in real-time. This facilitates increased interactivity in the presentation. It is also possible to develop new script statements further and use this software to assist in creating electronic books and educational videos.

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REFERENCES

[1] "Compilation of professional presentation software," *https://elearning.lacviet.vn/bai-viet/tong-hop-cac-phan-mem-thuyet-trinh-chuyen-nghiep-48.*

[2] "Top 8 famous modern interactive lecture preparation softwareavailabletoday,"*https://www.viewsonic.com/library/vi/giao-duc/phan-mem-soan-bai-giang-tuong-tac/.*

[3] Nguyen Thi Kim Hien, Nguyen Viet Anh, Pham Thi Lien Huong, "Applied research on some graphic software and means of communication to improve efficiency in education of technical graphics," *Journal of Water Resources & Environmental Engineering*, vol. 43, pp. 112-117, 12/2013.

[4] Nguyen Xuan Lac, Tran Kim Tuyen, "Simulation theory and technology in the teaching of descriptive geometry and engineering drawing," *HNUE Journal of Science*, vol. 59, No. 2, pp. 112-124, 2014.

[5] Nguyen Xuan Lac, "Introduction to Theories and Modern Teaching Technologies," *Vietnam Education Publishing House*, 2017.

[6] Nguyen Van Tien (project leader), Pham Tuan Anh, "Ministry-level Research Project B2003-28-87: Computerization in Teaching and Researching Descriptive Geometry-Technical Drawing," *Hanoi University of Technology, Ministry of Education and Training of Vietnam*, 2007.

[7] Marion Cottingham, "Mastering AutoCAD VBA,"*SYBEX Inc, Alameda, CA, USA*, 2001.

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