

Research on Mixer Parametric Modeling System Based on Redevelopment of ANSYS

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Abstract. In this paper, the mixer parametric modeling system software was developed by using VB which was taken as the foreground development program, and the paper combined with ANSYS software to create the finite element model of mixer blade and cylinder for the following numerical simulation of the flow field and parameter optimization of mixer. The software user interface was developed by VB and the pre-process model was created by invoking APDL of ANSYS in background. Therefore, the operation of modeling, meshing, component-building of mixer blade and cylinder were completed by using APDL and the graphic and text were outputted and displayed on the mixer parametric modeling system user interface which was developed by VB. Practice proved that it is convenient to modify the mixer solid model created by the parametric design language of ANSYS due to the similar structure.

1 Introduction

Mixing operation, using the role of mixer, enables the fluid material to flow at a certain flow pattern in the mixing container in order to achieve the mixed or dispersed purpose[1]. There are a lot of types of mixers with structure size varied, and the current primary mixer design method is the traditional experience design. However, the traditional experience design can be applied to only a few common mixer types, the process of computation is complex, and the error is great. Therefore, in the traditional experience design process, the work intensity of designers is large, the design efficiency is not high, and the design cycle is long and so on. Based upon APDL command stream file of ANSYS and the structure of mixer characteristics, this paper developed a program of mixer parametric modeling system, preparing for the future numerical simulation of flow field and the parameter optimization of mixer.

The parametric design language APDL of ANSYS is briefly discussed, and then modeling, meshing and component-building of mixer blade and cylinder are realized by using APDL language. Because the interactive mode and the aesthetics of APDL language is inferior to the higher computer programming language, the user interface was developed by the Visual Basic[2]. Through invoking APDL of ANSYS in background, this program can realize the modeling, meshing and component-building of the mixer blade and cylinder, and then save the corresponding data file in the specified directory, which will be useful for the future

numerical simulation of the flow field and parameter optimization of mixer[3].

2 Creating mixer model by APDL

The mixer parametric system includes three mixer cylinders: (1) flat mixer cylinder (2) conical mixer cylinder (3) elliptical mixer cylinder [4].

The mixer cylinder and baffle type need to be identified while establishing mixer cylinder model. Then, the corresponding parameters to establish APDL command flow also need to be input. Fig.1 gives the flowchart of establishing mixer cylinder.

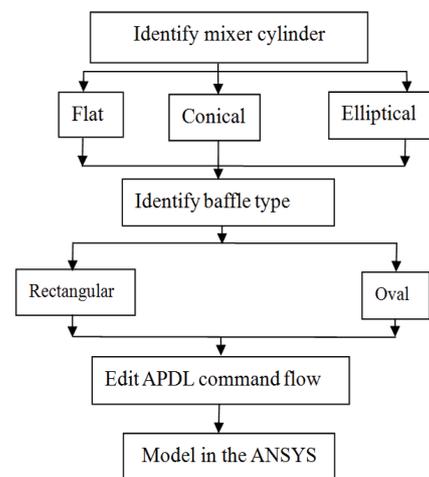


Figure 1. The flowchart of mixer cylinder

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The mixer parametric modeling system includes five mixer blades as follows: (1) paddle blade (straight leaves and fold leaves) (2) open turbine (straight leaves, fold leaves and curved leaves) (3) disc turbine (straight leaves, fold leaves and curved leaves) (4) anchor type (5) gate type. So the flowchart of mixer parametric system shows as Fig.2.

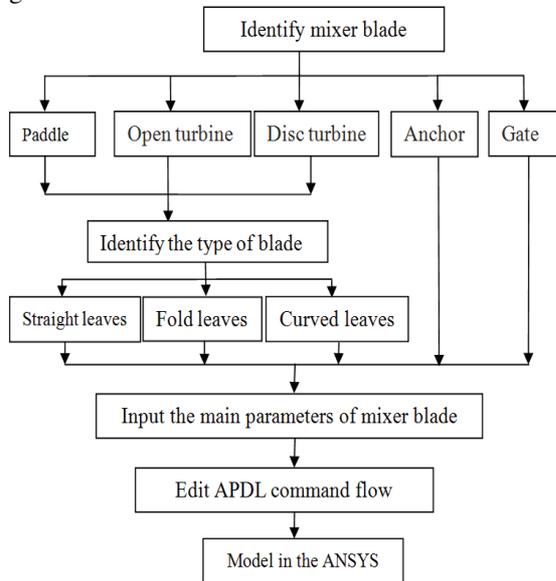
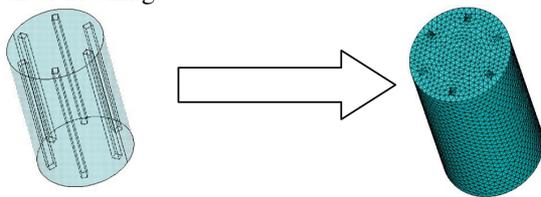


Figure 2. The flowchart of mixer blade

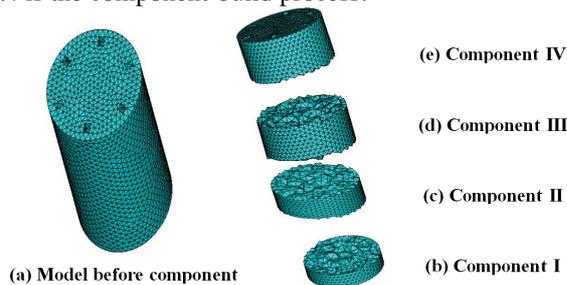
Meshing is not only one of the necessary steps in finite element analysis and calculation, but also the pre-process for the fluid dynamics simulation in the CFD software[5]. The Fig.3 gives the model of before meshing and after meshing.



(a) Model before meshing (b) Model after meshing

Figure 3. The process of meshing mixer cylinder finite element model

In order to simulate in the subsequent CFD fluid software, the components should be built at first. The Fig.4 is the component-build process.



(a) Model before component

(e) Component IV

(d) Component III

(c) Component II

(b) Component I

Figure 4. The process of creating component

After creating component, the mixer cylinder finite element model is divided into four zones: Component I, Component II, Component III and Component IV. By creating component, it provides great convenience for the future fluid mechanics numerical simulation.

3 Interface technology and data exchange between ANSYS and VB

Although the APDL language can realize some simple interface development, its interactive and aesthetical are inferior to the higher computer programming language. Therefore, the friendly and aesthetical user interface is developed through VB. In the mixer parametric modeling system, the user can invoke APDL in background to model, mesh, build component of the blade and cylinder. The following codes are the method which invokes ANSYS in the VB software[6].

```

If Dir (App.Path & "\" & "model.dat") <> "" Then
    Kill App.Path & "\" & "model.dat"
End If
Result = Shell ("d: \Program Files
\ANSYSInc\v120\ansys\bin\intel \ansys120.exe -g -b -i
d:\impeller.mac -o d:\blader.dat")
file-name-quit = ""
Do while file-name-quit = ""
    file-name-quit = Dir (App. Path& "\"
& "mixer.dat")
Sleep 20
Loop
  
```

Loop

Here, the “D:\ProgramFiles\ ANSYSInc \v120\ ansys \bin \ intel \ansys120.exe” is the directory of ANSYS; the “d:\impeller.mac” is the ANSYS input file which was compiled by APDL language; the “d:\blader.dat” is the output file of ANSYS.

When invoking ANSYS in the VB, it need add a judgment sentence at the end of the codes (i.e. file-name-quit = Dir (App. Path & “\” & “mixer.dat”)) to judge whether ANSYS is already completely executed. If ANSYS has run completely, VB will return the data files or graphics created by ANSYS to the main interface of the VB.

4 Interface design of mixer parametric modeling system

Interface design of mixer parametric modeling system includes mixer cylinder interface, blade interface I, blade interface II and model preview interface. Fig.5 shows the mixer parametric modeling system main interface.

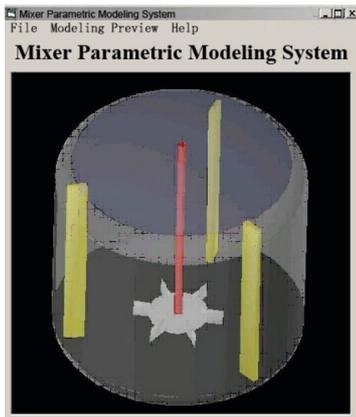


Figure 5. The main interface of mixer parametric modeling system

There are four menus in the main interface of mixer parametric modeling system. The file menu is used to open, save and close files. The modeling menu is used to select mixer cylinder interface, blade interface I or blade interface II. The preview menu is used for observing the mixer model from different angles. The help menu is similar to the help menu of general Windows application software.

The mixer cylinder interface design includes five parts (shows in Fig.6): the main parameters and shape of mixer cylinder, baffle, command button, viewpoint control and model preview.

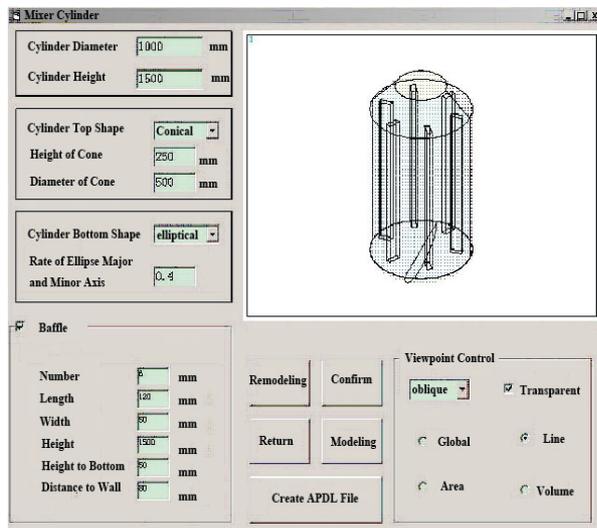


Figure 6. The mixer cylinder interface

The mixer blade interface design includes two interface designs. The first interface design is “Blade Interface I” and the second one is “Blade Interface II”.

The blade interface I design includes four parts (shows in Fig.7): blade parameters, viewpoint control, command button and model preview.

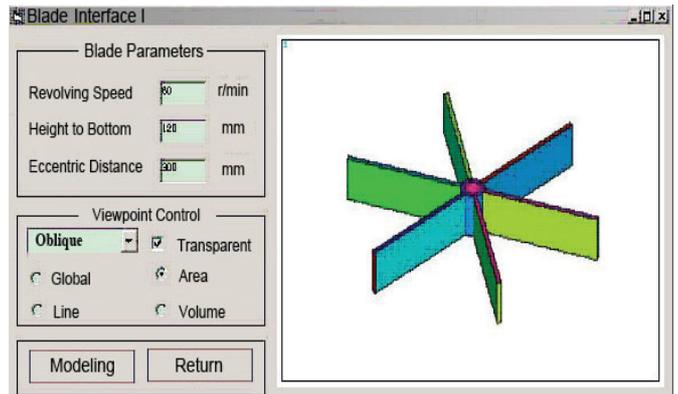


Figure 7. The blade interface I

The blade interface II design includes three parts (shows in Fig.8): blade parameters input interface, command button and model preview.

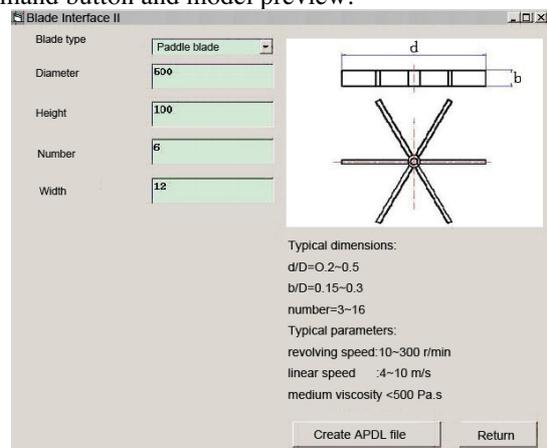


Figure 8. The blade interface II

There are six menus in the model preview interface (shows in Fig.9). The return menu is used to return to the mixer parametric modeling system main interface. The view display menu is used to display model using different ways, such as isometric view, oblique view, front view, right view, top view, back view, left view and bottom view. The preview menu is used for observing the mixer model from different angles. The opaque menu is used for displaying mixer model in transparent or in opaque, which is convenient to observe the inner structure of the mixer model. The meshing menu is used to mesh mixer model. The component-building menu is used to build component.

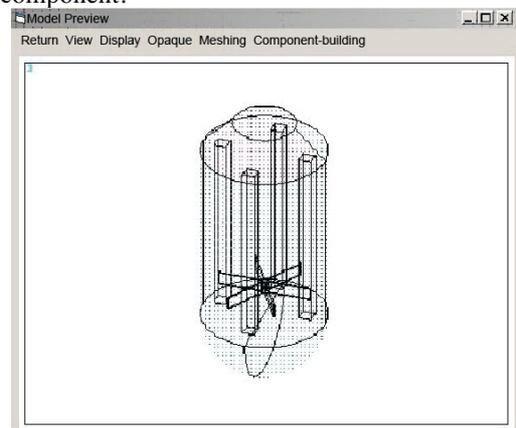


Figure 9. The model preview interface

5 Conclusion

The paper mainly discusses the data exchange between ANSYS and VB, and a set of mixer parametric modeling software is developed by using VB. Then, taking a six paddle blade and cylinder of mixer as an example, the main function of mixer parametric modeling system is discussed. Practice proved that it is convenient to modify the mixer solid model created by the parametric design language of ANSYS due to the similar structure. The designers can create mixer model, mesh and component-building of mixer blade and cylinder quickly by using the mixer parametric modeling system. It is significant to decrease the labor intensity, improve the work efficiency, and shorten the design cycle.

References

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