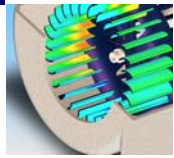
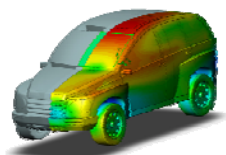


$\Gamma_\phi (\text{grad } \phi) = \omega S_\phi$
Whitepaper



Why is Engineering Fluid Dynamics (EFD) the Right Choice for CFD Analysis

And Why Other Programs Slow Down Your Progress



FLOMERICS
incorporating 

What is Engineering Fluid Dynamics?

Engineering Fluid Dynamics (EFD) is a new breed of Computational Fluid Dynamics (CFD) software that enables mechanical engineers to simulate fluid flow and heat transfer using 3D CAD models directly, with no need for data translations or copies. EFD is based on the same mathematical foundation as traditional CFD software, but key features set EFD apart, making it quicker and easier to use, more robust, and more accurate.

Why is EFD the right choice?

Reason 1: Using Existing Geometry

With most traditional CFD programs, you need to modify it substantially and then transfer existing CAD models to a different program in order to create a model for analysis. The main reason is that traditional CFD programs require a considerable amount of manual intervention. The translation process might work for 80% of the geometry but the rest has to be re-created or simplified by hand. Some users have reported wasting days waiting for their model to be transferred – if it succeeds at all! Therefore, many users have found it more reliable to start from scratch by creating the geometry in the CFD program (although this activity also involves a considerable expenditure of time).

Recently a company testing a traditional tool popular in the aerospace industry reported a difference of 2 weeks vs. 2 days with EFD. They reported that they spent a majority of their 2 weeks trying to get their geometry into their current traditional CFD tool. But the same complex geometry was transferred into EFD and analyzed in under 2 days -- that is a significant savings.

The main difference is that EFD uses native 3D CAD data directly for flow simulation. Flow conditions are defined directly on the CAD model and organized similarly to other design data in the feature tree. As a result, the original CAD model can be used without modification for analysis with EFD.

Reason 2: Simplifying the Model is Unnecessary

To understand how your design behaves in real world conditions, you need to simulate its performance in its operating environment. All analysis vendors recommend that you defeature your models. But then how do you know how far to take it and whether your analysis results will actually reflect their field conditions?

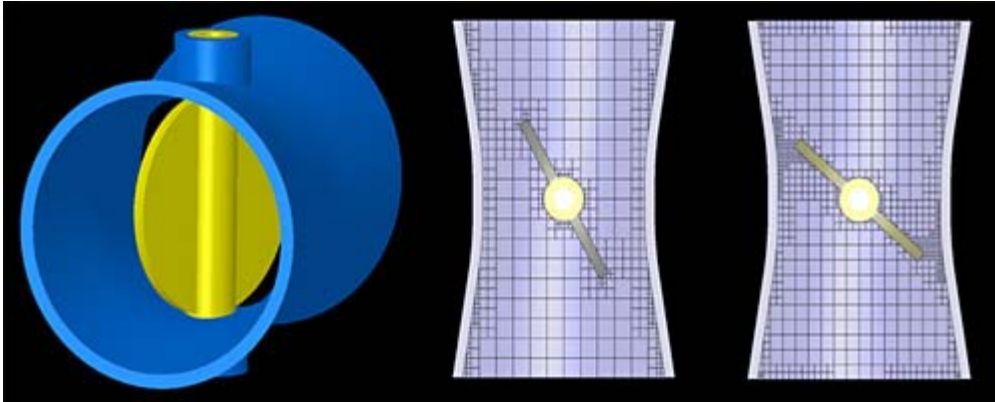
EFD is extremely robust and can handle very complex geometries. It can easily handle CAD geometries containing tight crevices and sharp angles without needing to defeature it. However, if you decide to simplify your model, you simply suppress the feature and proceed with preparing your model for analysis.

Reason 3: Effortless Meshing

Obtaining an optimum mesh is not easy and is perhaps one of the most important steps in the analysis process – after all, meshing directly affects the accuracy of the results. One airplane engine manufacturer spends a minimum of three months on finding the best mesh for their designs.

While automatic meshers have long been available, traditional CFD tools still require a considerable amount of manual intervention in order to maintain the quality of the mesh by eliminating gaps and overlaps, and maintaining the required skewness, aspect ratio, warpage and volume of individual cells. This manual process has to be repeated for every design change.

EFD offers you many tools and expert assistance on how to achieve an optimum mesh. It has an extremely robust automatic mesher for fluid and solid regions with automatic mesh refinement/unrefinement due to geometrical and or physical requirements. EFD also features grid-independent near wall modeling by using Partial Cells technology. This technology enables the software to correctly simulate the boundary layer phenomena for fluid flow and heat transfer effects. The result is that new parts and design changes can be meshed in a matter of minutes, dramatically reducing the time required for analysis.



Reason 4: Creating Additional Geometry is Unnecessary

When conducting fluid flow or thermal analysis, you are interested in understanding what's happening in the empty region and how it effects the solids which it comes into contact. However, the space which is filled with liquid or gas is not normally modeled as a separate solid.

Other analysis programs require you to create additional geometry in your solid modeller to represent this region. While some programs can create solids for internal flow volumes automatically unfortunately they do it indiscriminately. Therefore, they create them even for unnecessary isolated volumes that you're not interested in analyzing.

EFD can automatically identify all "empty" spaces -- the enclosed internal flow space and the outer flow area, as well as the solid areas of different materials involved in heat transfer. In addition, it excludes cavities without flow conditions to avoid unnecessary mesh creation.

Reason 5: Crystal Ball ... Not Needed!

With EFD you don't need to choose between turbulent or laminar flow as its modified wall function supports a laminar-turbulent transition model. In addition, EFD will account for compressibility automatically.

Reason 6: Effortless "What-if" Analysis

Solving flow and heat transfer problems is an iterative process – after seeing the initial analysis results, most users modify their models repeatedly in order to solve problems. When your design and analysis platform is integrated as in the case of EFD, after your initial run, you simply create multiple clones of your solid model. The cloned models retain ALL analysis data such as loads and boundary conditions. So when you modify your solid model, you can immediately analyze it without having to reprepare it. It really is that simple.

With other programs you may need to go back to the original CAD model and while you may be able to use the CAD cloning feature, after the translation process, you still need to reapply all

your loads and boundary conditions -- a real hassle if you want to analyze several versions of your model.

Reason 7: EFD is Affordable

Another factor that sets EFD apart is cost. Traditional CFD codes cost in the region of \$25,000 to lease for one year. An even greater cost for most companies is the need to hire experts to use the software. These analysts need to spend a considerable amount of time training in order to keep up with the latest changes in the code.

EFD substantially reduces the cost of performing fluid flow and heat transfer analysis. The software is reasonably priced for a *perpetual* license. EFD also can be used by mechanical design engineers with minimal training. Finally, EFD runs on personal computers and even laptops which cost just a few thousand dollars.

EFD is truly the right choice for best-in-class manufacturers.

Decision Checklist

Ask your vendor

1. Can you use existing geometry? If yes, how robust is the transfer process? Make sure to test their claim by checking their software with one of your existing models.
2. Do I need to simplify my models? How would I do it with your software?
3. What is the level of automated meshing available to me?
4. Show me how your software handles the empty flow region.
5. Do I need to designate the task to be laminar or turbulent flow?
6. Show me how to do "what-if" analysis.
7. Prove to me that design engineers can use your software.
8. What is your pricing mechanism: perpetual or annual lease?

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