INDY ENGINEERING SOLUTIONS, INC.

Email: ies@indyeng.com
Phone: (+1) 317 489 6853

Designing a robust centrifugal compressor thermodynamic-fluid model.

Discovering the Problem

A client presented IES with a set of older Fortran codes glued together with shell scripts. These codes formed a series of legacy programs. Developed in the 1970s and modified over the last 30 years, the original program was buried beneath layers and layers of modifications and work-arounds.

To compound the issue, all but one of the original developers left some time ago. The expertise needed to understand what the code did on the inside was forgotten. New testing development projects necessitated immediate updates to these codes.

Frequently, the obvious problem we are asked to solve points to underlying issues that should be addressed first. At IES, our team specializes in working with clients to solve the primary problem and to develop a better overall system.

This entails more than merely understanding ones and zeros. We take into account what engineering models are being used and what equations are being run in the background in order to come to a fuller understanding of what our clients needs are.

In this case, IES reviewed the code extensively, collected information from what expertise was there, and discussed with the engineers how they were using the program. This included gathering information about what they did and did not like about the current system. We also took into account what they wanted to do in the future with this code.

Crafting a Solution

In this case, we divided the work into two main phases. First, we analyzed the legacy source files and worked out what the programs were doing.

We determined not only how data flows through the particular piece of source code, but also what fluid-thermodynamic models and equations were employed to produce that set of source code.

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All of this information was gathered together into a software specification that we reviewed with the client before moving onto the second phase of the project.

In the second phase of the project, we used the approved software specification to develop a new program tailored to the client's needs. We used the prototypes developed while analyzing the legacy codes as a basis for the new program. From there we improved the engineering models to allow for future growth of the code.

Unique Aspects of the Project

In every project, clients have unique needs. IES is proud to rise to the challenge and deliver. In this project, we:

Created a gas model abstraction layer, so that they could utilize several different gas models. The final program linked to a proprietary client gas model as well as NIST's Reference Fluid Thermodynamic and Transport Properties Database (**REFPROP**).

Developed a Fortran based linked list to allow for greater flexibility in how they modeled the system.

Wrapped the code internally such that it was trivial to run design of experiments and other optimization programs on top of the design code.

And **Integrated** a test data mode that allowed processing test data through the same program to analyze the difference between design predictions and tests.

Preparing for the Future

Finally, IES worked with the client to incorporate the new program into their system. We delivered training classes to users, as well as training to the developers to maintain the code in a tracked software repository.

Experts in Engineering Modeling and Applied Scientific Coding