

Scientific Code plugin for Ansys Fluent

Company Background:

Dr. Gilmore works in High-Performance Computing (HPC) research support team in Mines ITS with the CyberInfrastructure Advanced Research Computing team. This project focuses on his PhD work for underground longwall coal or trona mining. This type of mining takes place in large underground blocks collapsing the above strata overburden layers cause ground disturbance called subsidence. The movement was simulated from three different mine locales data sets to validate the mining level change in porosity of the collapsed material, called gob. These region of the now abandoned mine fills with methane and mixes with the supplied ventilation air. Computational Fluid Dynamics simulations conducted in Ansys Fluent uses these sets of equations to calculate the flow resistance and final porosity. The user geometry of this region changes in size and so must the output of these equations according to known constraints. The Gilmore-Marts equations for underground longwall mining change in porosity comes from two dissertations write here at Mines and have been used in several following dissertations and used by researchers and the National Institute for Occupational Safety and Health (NIOSH).

Problem Description:

Ansys Fluent addins consists of C code with simplified header calls for function building, and a GUI interface for adjusting code variables at run time through Fluent Scheme Macros (see Fluent Customizations Manual: [CHAPTER 1: INTRODUCTION TO FLUENT USER INTERFACE CONCEPTS](#) . A set 6 equations for a bounded valid area defines a data set with 3 options to choose from for locale. Interpolation, extrapolation, and smoothing functions between data sets and valid regions will need variables for customization. Code kernels to converting porosity to flow resistance already exist, however, input constants are variable that will need input controls.

Team Size:

Three to Four team members.

Skills:

- Some working knowledge of C/C++ coding syntax
- Ability to learn Fluent Scheme from documentation
- Write documentation
- Work with 3D spatial data equations

Additional opportunities:

- Prepare abstract for publication at the Society for Mining, Metallurgy, and Exploration (SME) annual conference in Feb, 2024.

Interface-oriented user defined functions (UDFs) are UDFs that are meant to correspond to a custom graphical user interface (GUI). They provide an advantage in the ability to change data values whenever you need to without re-compilation. Furthermore, constructing a polished user interface to correspond to a UDF will create a consistent look and feel between Ansys Fluent and your UDF. This part of the manual will guide you through the process of creating a custom interface in Fluent that will allow you to edit and store data for later use by your UDF. Possible data types that are usable on your interface include integers, real numbers, Booleans (toggle buttons), strings, and lists. Throughout this part of the guide, you will be instructed in the process of creating an interface with each of these features, and learn how to save their values in a manner that can be accessed by your UDF.

The fundamental way in which you will create your custom interface is through the use of Fluent macros. Macros are Scheme constructs that are created by Ansys and are used in the development of the Fluent interface. Macros can have a variety of purposes in Fluent, including the use of [RP Variables](#), the creation of [Interface Elements](#), and the gathering of information from a mesh. As you read through this part of the guide, you will learn how to use a variety of Fluent macros as you learn to build a customized GUI.