FreeFem++ from 2d to 3d

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Abstract

A partial differential equation is a relation between a function of several variables and its (partial) derivatives. Many problems in physics, engineering, mathematics and even banking are modeled by one or several partial differential equations.

FreeFem++ is a software to solve these equations numerically in two dimension space and now in three dimension. As its name says, it is a free software based on the Finite Element Method; it is not a package, it is an integrated product with its own high level programming language.

Moreover FreeFem++ is highly adaptive. Many phenomena involve several coupled system, for example: fluid-structure interactions, Lorenz forces for aluminium casting and ocean-atmosphere problems are three such systems. These require different finite element approximations degrees, possibly on different meshes. Some algorithms like Schwarz' domain decomposition method also requires data interpolation on multiple meshes within one program.

FreeFem++ can handle these difficulties, i.e. arbitrary finite element spaces on arbitrary unstructured and adapted meshes.

I will explain how to develop such kinds of tools, and how to use.