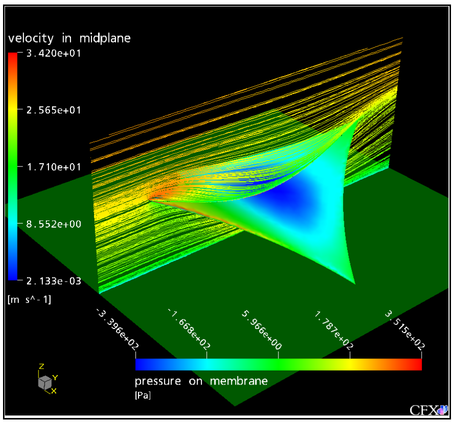
TECHNISCHE
UNIVERSITÄT
MÜNCHEN
Chair of
Structural Analysis
Prof. Dr.-Ing.
Kai-Uwe Bletzinger

27.11.2006

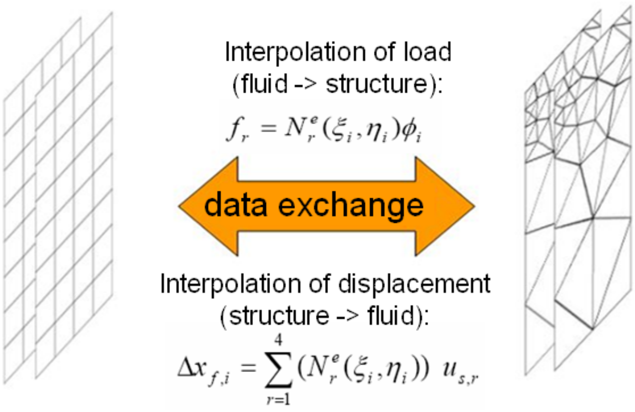
A Coupling Interface for the Data Transfer between Non-Matching Meshes

Area: Fluid-Structure Interaction

The analysis of coupled problems is quite new, interesting and challenging. Possible applications are the analysis of fluid-structure interaction (FSI), which occurs e.g. when the wind-flow around a structure deforms the structure considerably (like a tent, an airfoil or a membrane roof).



At the Chair of Structural Analysis, these problems are solved by a partitioned approach: the fluid-flow and the structural deformation are computed in two separate computer programs. The strong interaction between both physical fields is realized by the exchange of boundary conditions. In the case of FSI, these boundary conditions can be the pressure of the wind on the structure and the deformation of the structure. Since both physical fields are modelled in separated simulation codes, the discretisation at the interface is not necessarily identical in both codes. Therefore an interpolation of the exchange data between different interface discretisations becomes necessary.



The main task of this thesis is the development and the implementation of an algorithm, able to transfer data between non-matching meshes. Special focus is set on the data transfer between meshes of quadrilateral elements.

In a first step possible methods have to be analysed to select a suitable one for the implementation regarding efficiency and performance.
An object oriented C++ program for the data transfer should then be developed. This implies the implementation of two main functionalities: In order to find out to which structure element a fluid node corresponds, a neighbour search has to be performed. This can be done by the use of an octtree-like data structure. When the dependencies of the meshes are known, the interpolation can be performed. Attention should also be turned to the treatment of special cases which may occur when using bad meshes.
The code will be verified using significant examples and should also be applied on realistic applications.
An additional task could consist in performace tests and the comparison of different methods.

Necessary prerequisites for this thesis are fundamental experience in object oriented programming, ideally in C++ and interest in fluid-structure interaction.

If you are interested in this project, please contact me.

Ute Israel

Email: israel@bv.tum.de
phone: +49 (0)89 289 22435
room number N 1025