Topic 17:

Extending a 2D HO-FEM Code with parametric features using the Computer Algebra System *Maple*

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Background: Conventional FEM Codes use the cartesian geometry of the structure to be analysed and as a result the FE-meshes are given explicitly in these coordinates (x,y,z). Another approach is to parameterise the geometry. That is to describe it by certain parameters such as width, height, etc.. These parameterisation has to be represented in the mesh and also in the final equation system. The effort for this is big, but the advantage is large if parameter studies have to be done during the design process as the Final Equation system **K(a1,a2,a3)*x = F(a1,a2,a3)** can be calculated explicitly in dependency of the design variables (hole diameters, …). As within the Computer Algebra system *Maple* symbolic evaluation of Integrals is possible it will be used within this project.

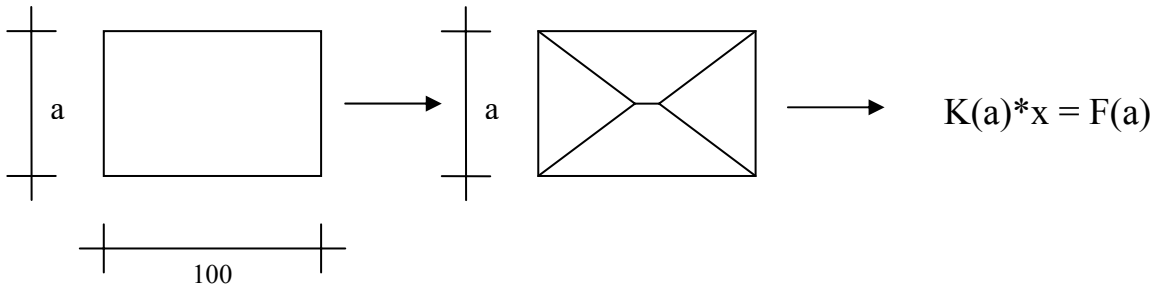

Figure: Parametric approach

Task of the software lab is to extend a 2D FEM Code given in maple with parametric features, that is a parametric description of a geometry, the mesh and efficient solution algorithms for the final equation system.

The task will include treatment of the following subjects:

- High order FEM,
- Parametric Geometry
- Programming in Maple

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References

[1] D. Yang. *C++ and object-oriented numeric programming*, Springer, 2001.
[2] E. Rank, A. Düster. *High Order FEM,* Scriptum 2006