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Dynamic analysis of high loaded components, discretized by fictitious domain methods

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The Hilti Group is a world-leading company specialized in the development, production and marketing of high-quality products that offer the construction professional innovative solutions with outstanding added value. The Hilti product portfolio includes drilling and demolition technology, direct fastening, screw technology, anchoring systems, diamond technology, firestop and foam systems, installation systems, measuring systems, cordless and cutting tools. This paper focuses on questions revolving around the development of power tools and accessories.

The chuck is a central component in electric power tools, which has to withstand high impact loads through the lifetime. The chuck encases the chisel and parts of the hammering mechanism in the machine and is responsible for the force and moment transmission during the operation of the machine. The optimal geometry design of the chuck plays a very important role in the quality and reliability of the system.

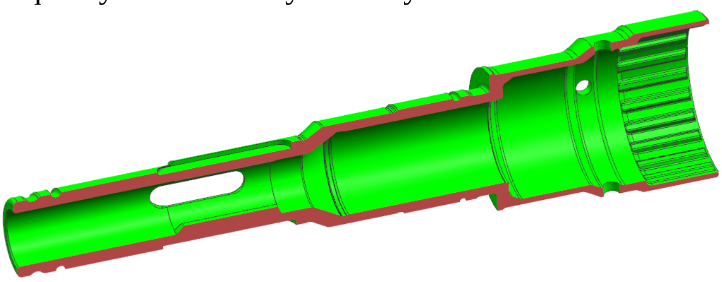

Figure 1: The geometry of chuck

The computational technique applied within the context of this work is the finite cell method (FCM, see [1]). It is a fictitious domain approach combined with high order shape functions. The basic idea is to extend the partial differential equation beyond the physical domain up to the boundary of a fictitious domain, which is a rectangle or a cube and thus can be trivially meshed with structured grids, so called cells. One major advantage of the FCM is the drastic reduction of the engineering modeling effort, as meshing for even very complex geometric structures can be avoided completely. The accuracy and convergence of this method have been investigated in different papers.

An extension of the FCM to dynamic problems for industrial applications is investigated in this contribution. A detailed comparison of the results with those from available commercial software as well as measurement will be presented. As the chuck in Hilti products is geometrically complex and permanently under dynamic impact load it is a suitable example for investigating the value of this extension of the FCM and gives a good insight in its efficiency and accuracy for dynamic problems. .

REFERENCES

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