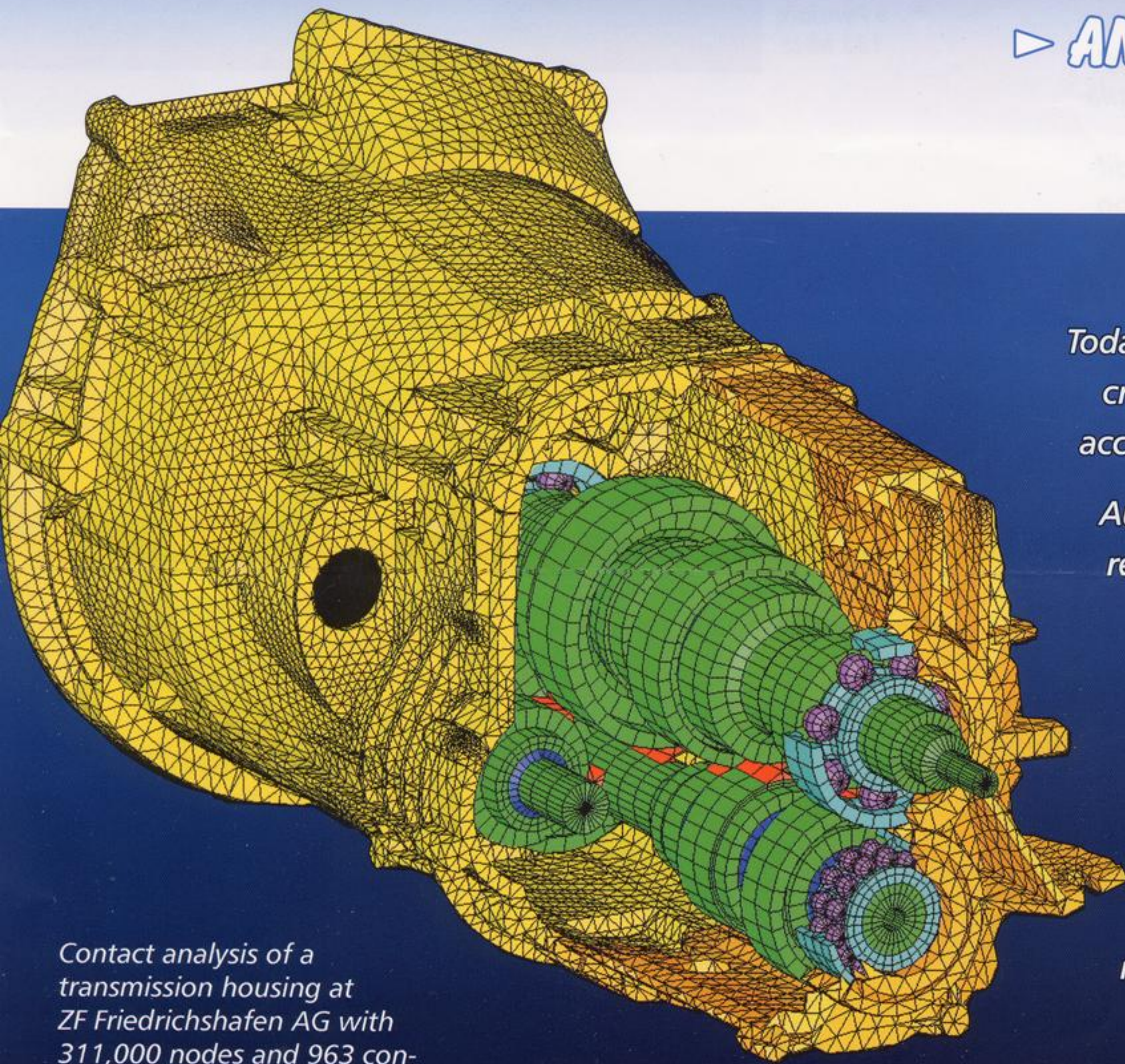


# PERMAS

## CONTACT ANALYSIS



- ▶ **CONVENIENT USE**
- ▶ **MAXIMUM SPEED**
- ▶ **LOW DISK SPACE REQUIREMENTS**
- ▶ **ANY MODEL SIZE**



Contact analysis of a transmission housing at ZF Friedrichshafen AG with 311,000 nodes and 963 contact node pairs.

The run has been performed with PERMAS 6.0 on a HP C180 computer in 7 hours (elapsed) using 100 MB central memory and 6.2 GB disk space.

*Today's FE analysts have an increasing demand for higher accuracy of their simulations.*

*Automatic mesh generation results in finer meshes, and complex physical phenomena have to be taken into account. Fast and accurate solvers are required, which are easy to use without any other limitations. In this respect, contact analysis is of increasing importance.*

*This challenge is successfully met by PERMAS Contact Analysis.*

## THE FEATURES

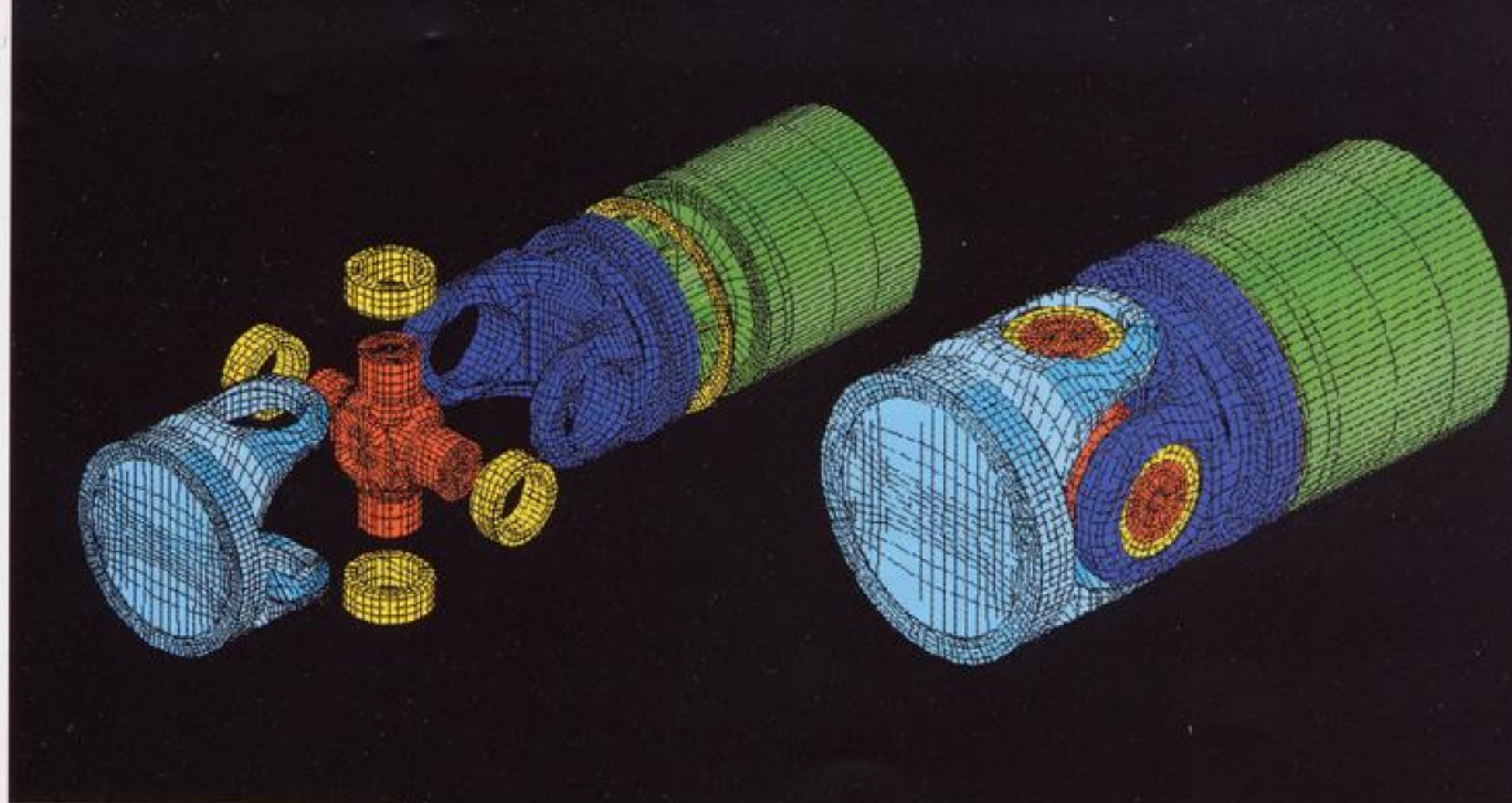
PERMAS Contact analysis (PERMAS CA) fully meets all user requirements:

- ▶ Contacts are specified by node pairs or corresponding node sets.
- ▶ Contact against ground does not require any modelling of the ground.
- ▶ Friction for slip and stick may be isotropic or anisotropic.
- ▶ Contact may be applied between three or more bodies.
- ▶ The contact forces are determined even in cases where the status of contact is specified as frozen.
- ▶ Initial gap widths may be taken from the geometry or from an explicit definition.
- ▶ Several contact variants may be handled in a single calculation: different gap widths, several loading cases and different coefficients of friction.

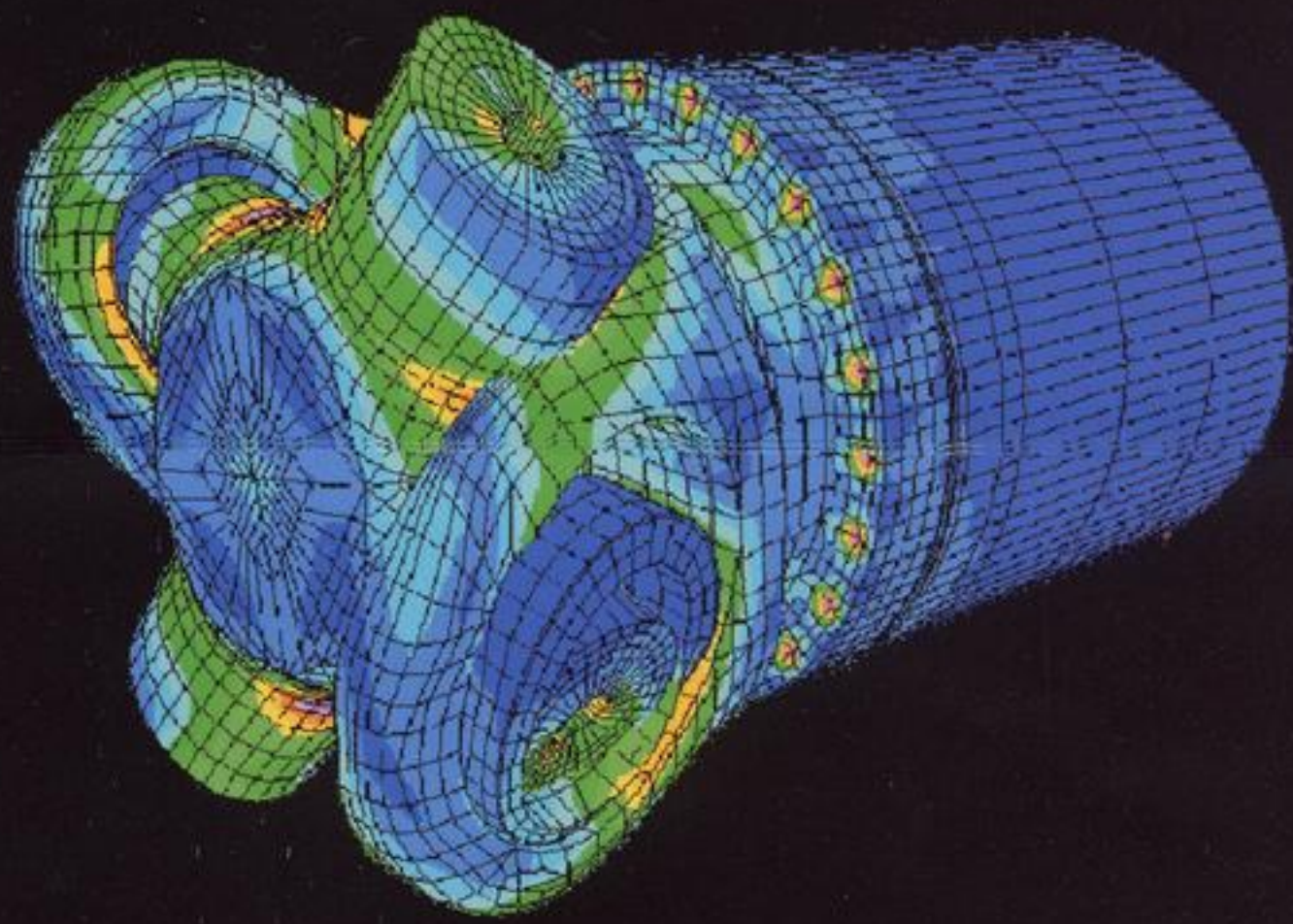
## THE ALGORITHM

Highest Performance is achieved by the PERMAS CA algorithm:

- ▶ The iteration is performed in a system where only the contact degrees of freedom are included. As a consequence, the run time for a contact analysis is not related to the

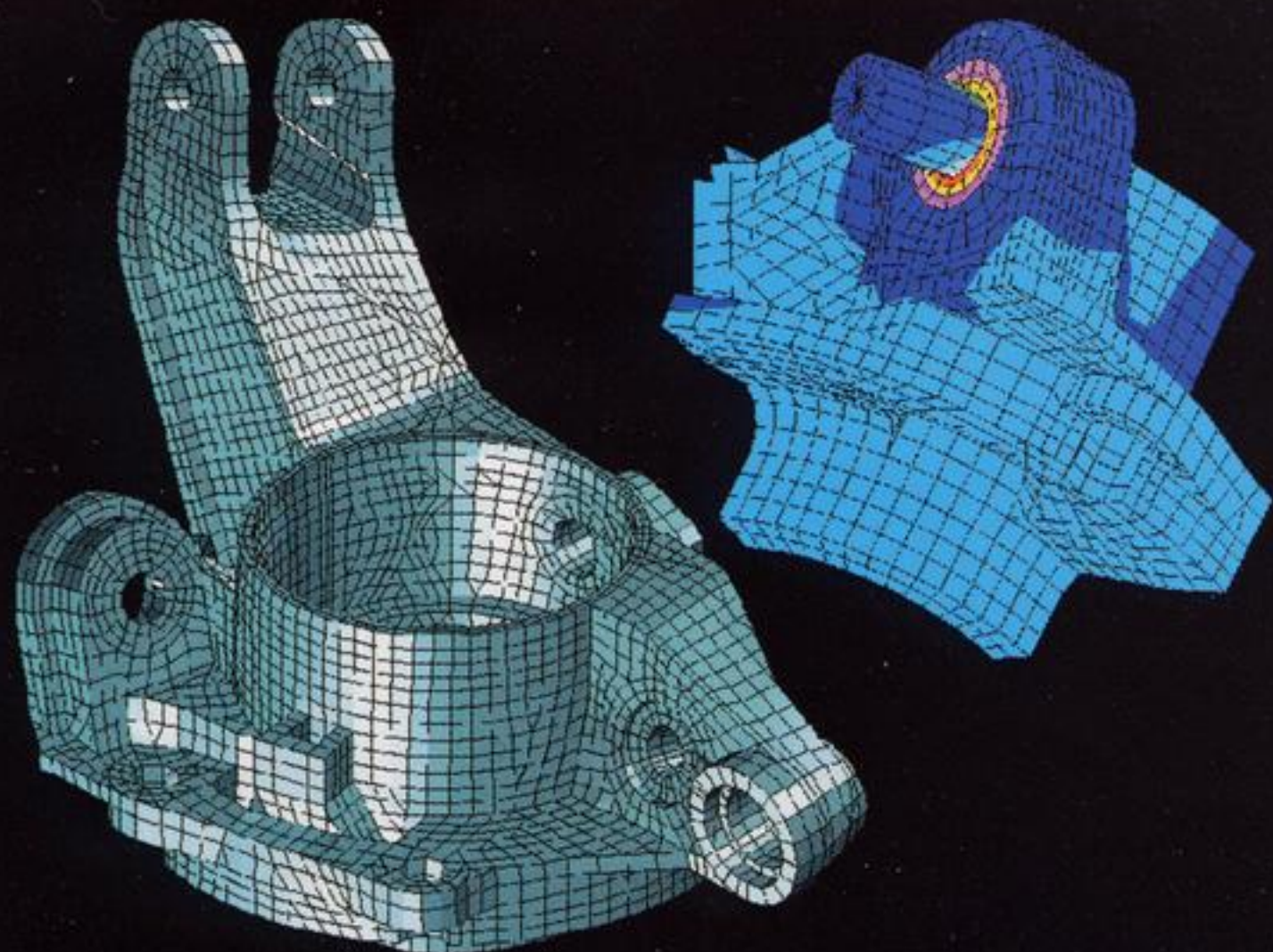


Contact analysis of a cardan shaft at Voith Turbo, Heidenheim: Assembly and nodal stresses over the deformed model (35,600 nodes, 1,952 contact node pairs). PERMAS 6.0 used 3.5 hours, 15 MB central memory and 735 MB disk space on a Pentium 133 MHz.



model size but to the number of contact node pairs only.

- ▶ Even for several contact variants the equation system is set up only once - resulting in a considerably improved efficiency.
- ▶ The numerical performance is neither disturbed by a penalty function nor by an artificial stiffness.



PERMAS contact analysis at Porsche: Model of a wheel bracket and stress results on a model part.

## THE BENEFITS

An increasing number of PERMAS users proceed to finer meshes and more contact points to model press fits, clamps, and all other types of supports.

Why not handle different gap widths for one press fit in a single run, when the time is not significantly increased?

Why not take into account complex support situations, when the input is so simple?

Why not model all rolling bearings in detail, when the algorithm easily handles complex meshes?

You will be convinced by the quality of the results!

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