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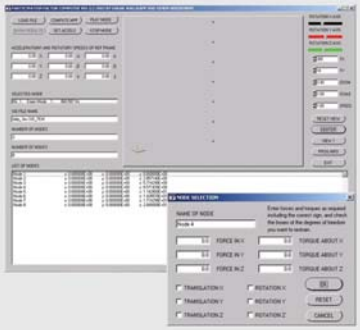
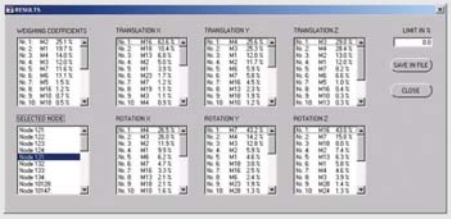
Optimising the Modelling of Flexible Bodies in MBS

Multibody dynamical simulations using flexible bodies usually need a careful selection of mode shapes to ensure that the results are as close to reality as possible. With the free software Mode Participation Factor Computer (MPFC), you can visualise your flexible bodies as stored in SID files, visualise their mode shapes, define boundary conditions and loads, and finally compute the share of each mode shape in the total elastic deflection prior to time consuming dynamic simulations.

It is well known that the quality of dynamical simulations incorporating flexible bodies depends on their modelling. More precisely, it depends on the selection of mode shapes taken into account for the simulations.
The Mode Participation Factor Computer (MPFC) helps you in selecting mode shapes for flexible bodies represented by SID files. After reading in such a file you can see your flexible structure made up of small dots, each dot representing a node or marker in SIMPACK. The more markers your body has, the richer its graphical representation will be. The MPFC will play each mode shape and thus gives you the impression of the vibrating body. You define boundary conditions for your flexible body by applying kinematic constraints and load cases. The latter can be subject to applied external forces or accelerations of the body frame of reference.
After you have defined the boundary conditions, the MPFC computes the mode shape weighing coefficients q for this quasi-static load case just as SIMPACK would do. Moreover, as the elastic deflection of one individual node or marker is the sum of the weighted coefficients multiplied by the mode shape deflections, you can calculate the share of each mode in the elastic deflection at each single node or marker along and about each of the three principal axes. That is with regard to each of the six spatial degrees of freedom.
In time consuming simulations you are usually only interested in some points in time or some load cases. You can estimate the loads in these situations of interest, or you can run a quick rigid body simulation to get an estimate. You use the MPFC to predict the behaviour of your flexible body for these load cases of interest. In SIMPACK, you then only select those modes that are above some level of significance that you define.
This way you can make sure that the mode shapes you select fit the expected load cases that arise in the later dynamic simulations. This might allow you to ignore a number of mode shapes that otherwise you would have to take into account, "just to be sure". It might also turn out that the mode shapes you currently have are not really suited for the expected load cases and should be recomputed with modified boundary conditions. Finally the MPFC can create tab separated log or data files for documentation and for further use by other or future programmes.
We are sure that the MPFC will ease your daily work with flexible bodies in SIMPACK. By playing around a bit, you will create a feeling of what to pay attention to and which modes to select. At www.fh-muenchen.de/fb06/professoren/wallrapp/e_forschung.html, projects, the MPFC and the manual are freely available for download.



The MPFC Main Window with Node Selection Window



The MPFC Results Window