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Epicyclic Gear Simulation with Overlapping Overset Mesh

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One thing most engineers have in common is a fascination for elliptic gears. And with the impending release of STAR-CCM+ v8.04, it will be easier than ever to set the wheels in motion.

Indeed, one of the most exciting features of STAR-CCM+ v8.04 is an enhanced overset mesh technology which allows for multiple overlapping overset zones. Overset meshes, also known as ?Chimera? or overlapping grids, may be used to simulate the relative motion of one or more bodies, including arbitrary or tangential motions of objects in close proximity. And whereas it has been possible to overlap overset grids with a background mesh since the release of STAR-CCM+ v7.02, it will now also be possible to overlap overset grids with each other.

The way overlapping overset grids work is quite simple: an individual mesh is generated around each moving object and is then moved at will over a background mesh. Since in most cases using overset meshes does not require any mesh modification after generating the initial grid, parametric optimization studies can easily be performed and automated. It also means that local grid refinements can be more easily controlled throughout the simulation since the overlapping cells are either active or passive, but are not deformed as the simulated object(s) shift position.

Let?s take the example of the epicyclic (planetary) gear shown in the video below. The gears were created directly in STAR-CCM+ using the 3D-CAD modeler. The planet gears (red) are being driven by the sun gear (blue) while the ring gear (yellow) remains still. Simulating such a scenario would be a nightmare without overset mesh: the mesh would have to be adapted (either morphed or fully regenerated) at each step of the rotation, which would result in substantial time and resources being needed. However, using a background mesh for the ring gear and overlapping grids for the sun gear and each of the planet gears means that only the connections between the meshes need to be computed at each step. It also means that since the same grids are used throughout the simulation, you can be sure that any modifications in the results come from the flow, and not from the grid settings.

The Overset Mesh capability is fully compatible with the full range of structured or unstructured meshing options in STAR-CCM+. With no need to worry about interconnecting meshes or cell distortion, this capability brings genuine moving object simulation within the grasp of all engineers.

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