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## STAR-CCM+ v9.04: CAD Robustness and Adjoint expressions



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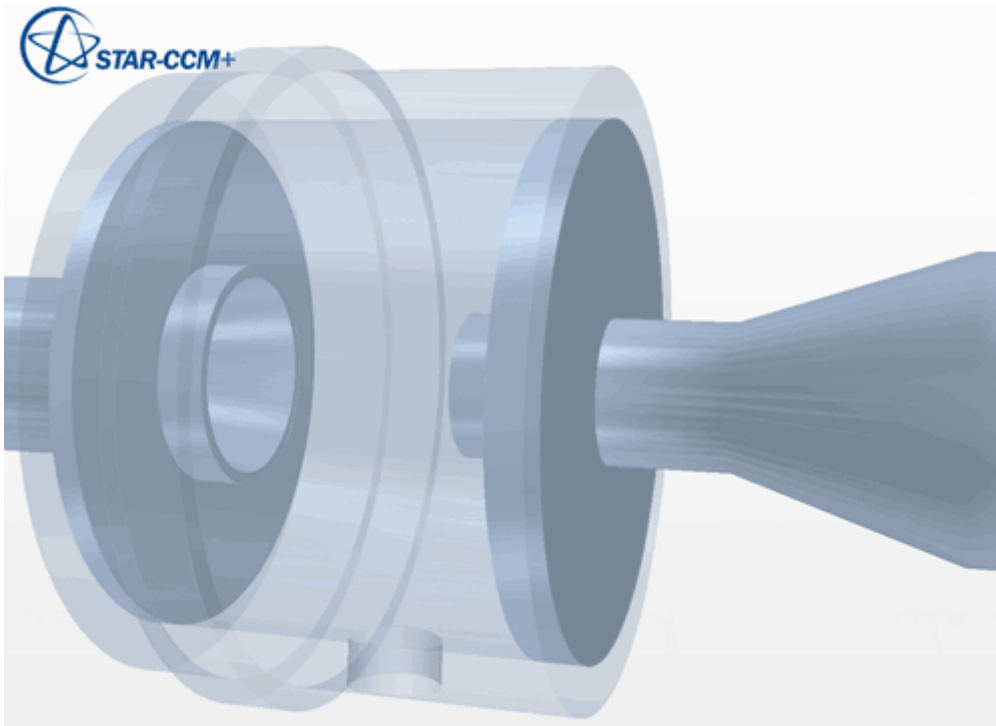
During the opening session of the [STAR Global Conference](#) <sup>[1]</sup> earlier this year, Didier Halbronn, CD-adapco Vice President of European Sales, spoke about our ongoing commitment in the field of multi-disciplinary design exploration (MDX). In this blog I want to highlight a couple of new features in v9.04 of STAR-CCM+ that approach this in different ways.

### Ensuring Robust CAD

One of the challenges of parametric optimization is ensuring that the CAD model is tolerant to the full range of variations that the product is likely to encounter (both in its operational life and during the optimization process). As model sophistication grows and parameters may become interrelated, it is hard to know up front how robust your model is to variation and how many regeneration failures you may have.

Too many CAD regeneration failures and you can't have confidence that your design truly is the optimum or that the relationships between inputs and outputs in your DOE are valid. While the CAD regeneration step is usually short, the simulation that follows it may be more time consuming and if you don't have confidence in the result due to the number of failures, a lot of time may be wasted.

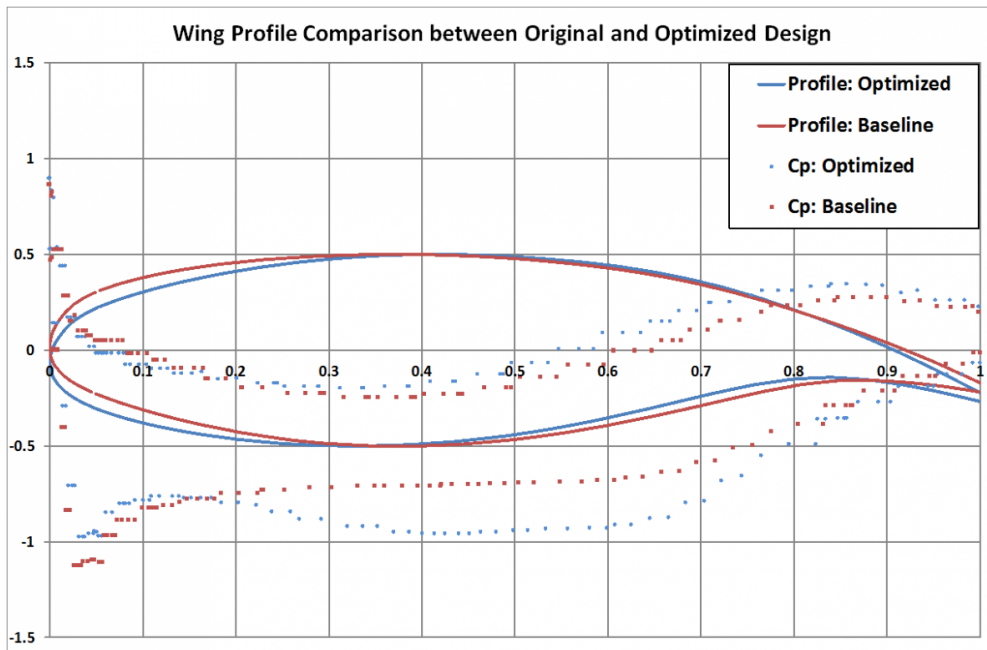
To alleviate this issue, v9.04 of STAR-CCM+ /Enabling Optimate and Optimate+ has the option to perform a CAD robustness study. This study, performed before the full analysis, allows you to quickly check the robustness of your design ensuring that time isn't wasted performing simulations that may be wasted due to failed geometry regeneration. Not only does it save you time, it also gives you confidence that you can truly find better designs faster.



## Tying Objectives Together

While STAR-CCM+ /Enabling Optimate+ provides a compelling solution for parametric optimization and sensitivity analysis it is not the only tool we have for MDx. For non-parametric studies, where geometry modification is not constrained by a CAD model, the STAR-CCM+ adjoint solver is a powerful method for exploring your design space in a more free-form way.

The adjoint solver <sup>[2]</sup> gives you information about how changing the shape, flow field and boundary conditions for your design will affect your cost functions, which represent your engineering objectives. In common with parametric optimization, you will often want to look at a combination of different objectives and how sensitive they are to your design. From STAR-CCM+ v9.04 onwards this is now possible with adjoint as well.



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## Links:

[1] <http://www.cd-adapco.com/blog/stephen-ferguson/simulating-systems-sgc14-highlights>

[2] <http://www.cd-adapco.com/webinar/using-adjoint-solver-gain-greater-insight-product-behavior>

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