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New Release: STAR-CD and es-ice v4.22

STAR-CD and es-ice v4.22 is now available for download.

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CD-adapco?, the largest privately held CFD focused provider of Computer Aided Engineering software, today announced the release of v4.22 of STAR-CD® and es-ice? IC Engine simulation software. The v4.22 release provides extensive refinements to existing physics models and pre-processing developments to deliver rapid and more accurate in-cylinder simulation.

es-ice has been enhanced with an automatic meshing capability for full cylinder models. Geometries can now be easily meshed with a minimum of inputs using one simple panel. Additional engine specific results, case details, and simulation settings have been added to the summary report and it is now possible to export an Excel workbook of the complete simulation post results. Automation has been further improved with the addition of several embedded Excel driven scripts. The complete sector simulation process and results animation and plotting processes can now be driven via Excel input and are available directly from within es-ice. Additionally, a full model can now be reflected from a trimmed half model to ensure perfect symmetry of the mesh.

The ECFM-CLEH model has been extended to allow combustion of multi-component fuels or dual-fuel engines, including oxygenated fuels. As with ECFM-3Z, the ECFM-CLEH model uses a library-based approach to incorporate the effects of complex chemistry. In addition to

the libraries for standard fuels that are delivered to users, it is now also possible for users and other 3rd parties to generate their own fuel chemistry libraries for autoignition, laminar flame speed and equilibrium according to an open format provided by CD-adapco and providing they have appropriate chemistry mechanisms and software.

Libraries for the CO model, which is part of ECFM-CLEH, are included in the installation.

All libraries now use equivalence ratio rather than mixture fraction as one of the independent variables as this is more accurate for engine operating points with substantial EGR. Additionally, the libraries available with the model have been extended in equivalence ratio, pressure and EGR dimensions to provide users with a wider range of engine operation.

The robustness of the higher-order MARS differencing scheme has been improved especially for the NORA NOx and soot models whilst maintaining the same computing time.

The soot sectional method, which is important for calculating soot size distribution, has been extended to operate with all ECFM and PVM-MF combustion models.

The PVM-MF (Progress Variable Model ? Multi-Fuel) model, first introduced in v4.20, has seen a number of enhancements for v4.22 release. PVM-MF is a detailed chemistry-based combustion model that is able to operate under low Damkohler number combustion regimes that can occur under lean, rich or high EGR engine operating conditions. It has full 3D cell-based flame resolution, in contrast to zonal or representative flamelet models and can cover premixed, diffusion, HCCI or mixed-modes of combustion. Since its first release, the model has been refined in a number of areas and for dual-fuel operation. Fuel libraries for gasoline, diesel, natural-gas have been updated and an additional library for natural-gas?diesel (dual fuel) are available from Customer Support. This approach gives an extremely efficient and low cost approach to modeling these engine types and it is now also possible to support user fuel libraries and chemistry mechanisms.

The evaporation and mixing of complex fuel mixtures is critical to today?s DI gasoline engines. To improve modeling accuracy in these engines, refinements to the existing Raoult?s Law multicomponent model have been introduced to enable the evaporation of ethanol-gasoline mixtures to be better represented. The UNIFAC models, available in STAR-CD v4.22, provide a framework for modeling mixtures where the molecular structure of fuel components is substantially different and is generally applicable to engine bio-fuels. In addition to the Lagrangian spray model, the implementation allows for all aspects of fuel evaporation including impingement and all wall-film regimes.

An additional option for heat transfer has been introduced in STAR-CD v4.22. This model provides an easy-to-use and computationally economical method for calculating crank-angle resolved changes in structural temperature and the effect on in-cylinder processes. Changes in surface temperature during the engine cycle can be significant for spray-wall impingement, during combustion and if there is any thermally insulating layer. The model assumes locally 1-dimensional heat transfer within the structure and is solved on multiple 1-dimensional meshes normal to the surface, these being generated internally through the specification of a few simple dimensional and thermal property parameters. Multiple material/layers, including contact resistance, can be incorporated and can be specified independently on all major components, ie the piston, liner, cylinder head and valves. Initial and boundary conditions can be either prescribed by the user or mapped from a cycle-averaged structural solution.

STAR-CD v4.22 provides a number of new capabilities to support the continued development of STAR-CD in-cylinder LES capability. Proper Orthogonal Decomposition (POD) is a powerful analysis technique for the quantitative analysis of LES calculations that can used to examine and compare different modes of a nominally cyclically-repeating flow and which is now available to the user. The improved Werner-Wengle wall model, which allows for SGS viscosity effects to be included in the fully turbulent region of the wall boundary layer, is now available. This simple yet effective model has been demonstrated to improve the correlation of wall friction factor. Finally, the discretization of the strain-rate has been improved that demonstrably improves small-scale dissipation. Further evaluation of these new capabilities will continue with CD-adapco IC engine university partners during the coming year.

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About CD-adapco

CD-adapco (http://www.cd-adapco.com [4]) is the world's largest privately held CFD focused CAE provider. Our core products are the technology-leading simulation packages, STAR-CCM+ and STAR-CD. The scope of our activities, however, extends well beyond CFD software development to encompass a wide range of CAE engineering services in fluid dynamics, heat transfer and structural engineering. Our ongoing mission is to "inspire innovation and reduce costs through the application of engineering simulation software and services."

A privately owned company, CD-adapco has maintained 17% organic year-on-year growth over the last 5 years. CD-adapco employs 850 talented individuals, working at 30 different offices across the globe.

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CD-adapco is the world's largest independent CFD focused provider of engineering simulation software, support and services. We have over 30 years of experience in delivering industrial strength engineering simulation.

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