MATRIX | ENGINEERS OF INNOVATION

Computational Fluid Dynamics (CFD)
Capabilities Statement

MISSION STATEMENT

To deliver results of business advantage for our customer through the application of world class technical computing solutions backed by leading professional expertise, responsive customer relations and long-term business partnerships

SOFTWARE SOLUTIONS

CD-Adapco STAR-CCM+, STAR-CD, STAR-Design for CFD and DEM flow analysis

EXPERTLY TRAINED AND EXPERIENCED CAE PERSONNEL

Don Campbell
- BSc, BE(Hons), PhD, MIPENZ (Mech), CPEng, IntPE, NAFEMS Advanced Registered Analyst, over 45 years CAE/FEA experience across many industries.

Paul Bosauder
- BE(Hons), NAFEMS Advanced Registered Analyst, over 20 years CFD/FEA experience, specialisation in CFD, heat transfer, non-linear, and composites.

James Cheng
- BE(Mech), ME(Mech), over 18 years in FEA, fracture mechanics, material and structural failure analysis, pressure vessel design, plastics injection molding.

James Hamilton
- BE(Hons), PhD, over 20 years FEA, experience in acoustics, CFD, aerospace and software customisation, rigid and flexible body dynamics, highly non-linear simulation.

EXAMPLE CFD CONSULTING PROJECTS

Electronics
- Predictive thermal flow analysis in an LCD unit to optimise geometry for maximum heat transfer (natural and forced convection) from an LCD unit to ambient air

Power Generation
- Spray scrubber simulation and optimisation in a geothermal power station to optimise scrubbing efficiency and determine fluid loads on the spray nozzle system
- Optimisation of cooling tower layouts to minimise the effect of exhaust plume recirculation
- Aero-acoustic analysis of gas turbine air intake silencer baffles to predict vortex shedding and transverse pressure wave frequencies
- CFD optimisation of hydro intake screen vanes including large scale modelling of channel and headrace to penstock transition
- Optimisation of flow in a steam turbine exhaust duct to reduce pressure losses
- Analysis of steam generator/superheater bank to predict pressure losses and estimate local velocities and turbulent intensities
- CFD modelling of the cooling and hot-gas flow paths in a Frame 6 gas turbine to predict thermal loads on key structural components
- CFD study of hydro intake casing, vanes and runner to provide localised flow conditions for detailed runner design
- CFD analysis of asynchronous wicket gate operation to determine stay vane loads

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CFD Capabilities Statement, *continued*

EXAMPLE CFD CONSULTING PROJECTS

Plant and Process

- Combustion analysis of a complete reformer including simulation of burners and reformer tubes
- Detailed flow and thermal analysis of heat exchanger coils and header considering combined flue and process gas flows with radiation, forced convection and conduction
- Coupled flow and thermal transfer analysis of a concentric air heater including radiation, forced convection and conduction; ultimately leading to the development of an Excel based design tool for concentric air heater designs
- CFD analysis of combustion in burners to determine the root cause of localised hot spots
- Simulation of flow and heat transfer in converters to determine fluid and thermal loadings. Includes DEM simulation of catalyst pellets to determine loadings on converter tubes
- Fluid induced vibration analysis of a heat exchanger to determine the likelihood of resonance of the heat exchanger tubes near the inlet nozzle
- Coupled fluid/structural analysis of the flow induced vibration of a vortex separator
- Combined radiation, forced convection and conduction thermal analysis of high temperature gas heat exchanger at cone intersection
- Conjugate heat transfer analysis of steam dryer drum to calculate transient heat-transfer coefficients during system start-up
- Multiphase analysis of pump intake designs to predict the onset of air entrainment.
- CFD analysis of heat exchanges investigating tube bank flow impingement, pressure distributions and general heat transfer design effectiveness
- Multiphase simulation of CIP processes in a tank including spraying, liquid build-up and venting to determine transient pressure and thermal loads

Bio-Mechanics

- Investigation of aortic blood flow with varying geometries observed in humans

Engineering Design

- CFD optimisation study of a multi-stage jet sprint turbine and intake
- Design optimisation of shower venturi mixer to optimise shower temperature and flow rates
- Drag force analysis of a prototype drill lubrication path involving the interaction of multiple moving components and mesh morphing techniques
- Flow and aeroacoustics analysis of a frost fan to optimise fan performance and minimise noise
- Transient thermal analysis and subsequent thermal stress analysis of die base
- Thermal analysis of light fittings to optimise thermal performance for natural convection and radiation heat transfer
- Simulation of flow paths in a rock crusher with a rotating impellor to predict regions of wear and internal mass flow paths

ADDITIONAL CONSULTING CAPABILITIES

- Finite element analysis
- Composites analysis
- Moldflow injection moulding simulation
- Design & optimisation
- Fitness for service assessment

WE UNDERSTAND TECHNICAL COMPUTING

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