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

- Siemens STAR-CCM+
- ANSYS Fluent

EXPERTLY TRAINED AND EXPERIENCED CAE PERSONNEL

Kava Crosson-Elturan
- BE(Hons), (Mech, Purdue), numerical simulation FEA/CFD, physics-driven design, over 18 years' experience across the aeronautical, software, rail, marine and engineering consultancy industries.

Marijn Wouters
- BSc, MSc (Hons) Aerospace Engineering, specializing in Aerodynamics, over 10 years CFD + CAD experience in aeronautical, automotive and lithographic industry. Microfluidics, rarefied flow regimes, electromechanical designs and rapid prototyping

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

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

Guido Quesada
- MSME, ASME, FEA, advanced Abaqus instructor, pipe joints, product development, over 23 years' experience.

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

EXAMPLE CFD CONSULTING PROJECTS

Electronics
- Cooling analysis of a submerged marine sensor with over 170 internal parts considered
- 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
- Simulation of two-phase pipeline flow including entrained solids and lengths > 1 km
- 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

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

Computational Fluid Dynamics (CFD) Capabilities Statement, *continued*

EXAMPLE CFD CONSULTING PROJECTS

Plant and Process

- Thermal performance of large high-temperature air-air heat exchanger with 900 individual tubes
- 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 exchangers 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

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
- CFD of microfluidic multiphase flow to simulate pressure propagation
- Simulation of flow paths in a rock crusher with a rotating impellor to predict regions of wear and internal mass flow paths

Water Treatment

- CFD simulation of differential fine particulate settlement in stormwater traps including efficiency
- Resuspension of sediment due to high flow events
- Simulation of large water treatment plant performance and overflow potential
- Screen filtration simulation

ADDITIONAL CONSULTING CAPABILITIES

- Finite Element Analysis
- Composites Analysis
- Moldflow injection moulding simulation
- Design & Optimisation
- Fitness for Service assessment

WE UNDERSTAND TECHNICAL COMPUTING