WELDING SIMULATION & ADVANCED SOLUTIONS

$$Displ. = h\left(1 + \frac{X}{L}\right)\left(1 - \frac{X}{L}\right)$$
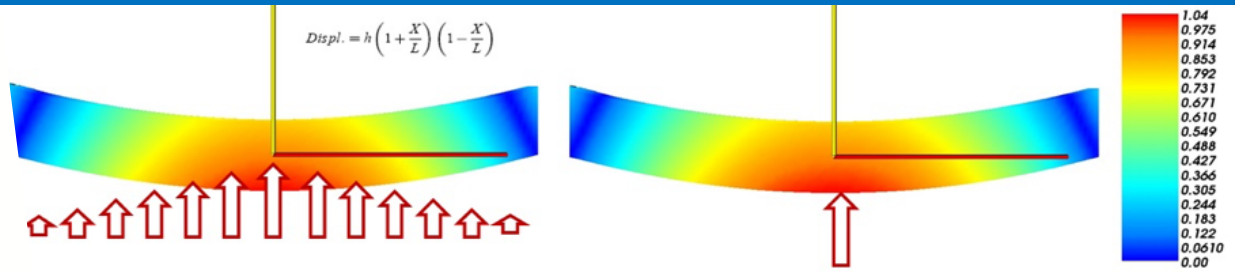
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INOVATIVE SOLUTIONS TO WELDING PROBLEMS

As Canada's premier provider of welding engineering services, SKC Engineering is now capable of using modern high power computing methods for designer-driven optimization of welded structures and related welding procedures for all levels of application. Using the state of the art VrWeld platform for simulation and weld modeling, combined with our extensive practical experience, our welding engineers apply their creativity, expertise and skill to be optimal, more productive, and innovative when developing solutions to welding problems.

Weld distortion is the most frequent problem in welding applications and many techniques have been developed over time to mitigate distortion or in some case achieve zero distortion. Simple techniques like tack welding and fixturing can now be optimized using welding models that reliably predict distortion. Furthermore, simulation and modeling enables the designer to optimize complex methods like pre-offset, side heating, trail cooling, or more advanced techniques including adaptive clamping and process control.

Welding sequence and intermittent welding design, which determines the best welding pattern in multi-pass welds, are familiar techniques to control the distortion when dealing with multi-pass welded structures. Finding the best solution for such a design is limited by available resources since a designer needs to pick one out of many patterns i.e. hundreds to thousands patterns, usually based on experience. Optimization of this problem is not feasible through shop trials, so we use computer modeling that automates implementation of several patterns for minimal distortion, residual stress, or other design objectives. Using our signature technique based on surrogate modeling we can efficiently select the best pattern out of tens of thousands of pattern or all possible weld sequence configurations.

Residual stress affects the service life and condition of weldment during course of service if it doesn't introduce immediate problems during the manufacturing process. Weld modeling is the most cost effective method to generate a 3D map of all stress components during and after welding as well as interaction with operation loading condition for fatigue and creep analysis. This leads to optimal design for enhancing service life and can avoid further cost of rejected parts from service.

Microstructure evolves inevitably through the rapid heating and cooling cycle from welding and this evolution differs from point to point in the weld and Heat Affected Zone (HAZ). Given the 3D transient temperature field from welding, simulation plays a key role to predict local microstructure changes and our model predicts the evolution of steel's microstructure based on transformation of Gamma to form phase fraction of Ferrite, Pearlite, Bainite, and Martensite. The Vickers hardness of the alloy can also be computed by using the rules of mixture from volume fraction of phases and cooling rates.

Repair welding is among the most challenging aspects of welding engineering. We are capable of modeling weld and welding procedures on existing structures for an optimal repair process that will be validated through our experimental lab and mock-up tests to assure delivery of high quality and risk-free repair procedure.

When repair isn't possible SKC offers fitness-for-service (FFS) assessment at levels 1, 2 and 3 (API 579/ASME FFS-1, BS 7910) using state-of-the-art computer modeling packages. Based on these computations, the criticality of flaws detected by visual and non-destructive methods can be determined, and the remaining life of the component/asset predicted.

SKC

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