Development of Design Software for Weld Overlay of Pressurizer

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1. Introduction

As a result of Primary Water Stress Corrosion Cracking (PWSCC) in alloy 600, leaks in dissimilar metal weld (DMW) of pressurizer nozzles were discovered recently in several US plants. The involved companies developed advanced repair techniques [1][2][3][4] to prevent or repair PWSCC applying weld overlay procedures to dissimilar metal welds such as those between pipes and nozzles. Within 2 or 3 years, more than half of the nuclear power plants in Korea will have been in operation for more than 20 years.

The weld overlay technology consists of overlay design, design & manufacturing of welding system and procedures. DMW zone in pressurized nozzles has different shapes and sizes. If shape and size of DMW zone in pressurized nozzles is different, the overlay design will be performed again. The welding system also will be designed and manufactured each types of nozzle. In order to minimize the similar works, related tool will be needed.

From this background, the 3D Simulation software, dNOSS (doosan NSSS Overlay 3D Simulation Software), has been developed to apply full structural weld overlay for DMW.

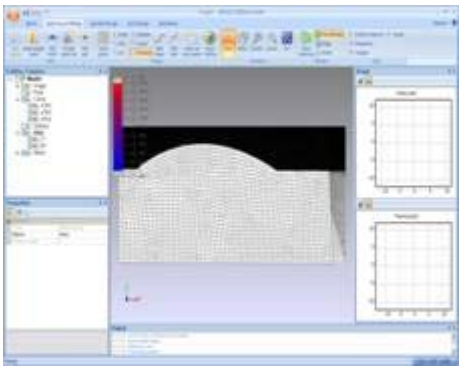
2. dNOSS Development

2.1 Integrated Environment

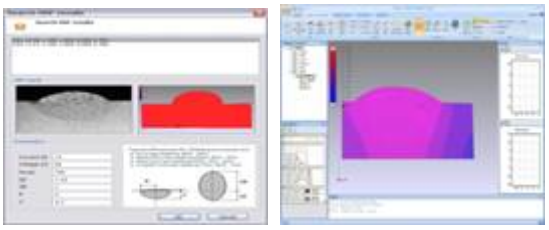
The dNOSS consists of heat source fitting(HSF) module, overlay design module, overlay tool design module & 3D simulation module. The integrated environment based on Windows XP and the user interface was designed similar to Microsoft Office 2007.

2.2HSF & Overlay design Module

Figure 1 and 2 show HSF and overlay design module. The HSF module consists of meshing part, welding parameter input part, HSF part and optimization. The overlay design module consists of pipe shape input part, meshing part and residual stress analysis part. The analysis tool for HSF and residual stress analysis used the SYSWELD that is special analysis tool made by ESI. The characteristic of SYSWELD is to simulate the welding parameters for describing actual heat source. The dNOSS is connected with internal tools using a Wizard function.



(a) Meshing part



(b) Welding condition input & optimization part

Figure 1. Heat source fitting module

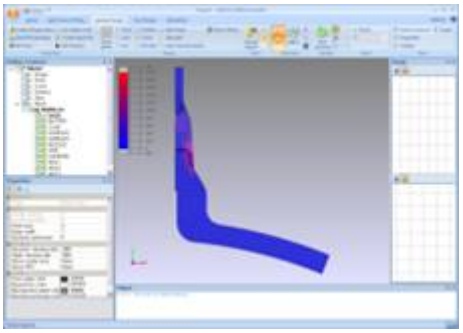


Figure 2. Overlay design module

2.3 Overlay Tool design Module

Figure 3 shows overlay tool design module. This module consists of tool design part, structural analysis part and interference check part. This module is performed tool design to optimize welding system in various nozzle shapes, sizes and environments. The design uses the templates model and the structural analysis tool is ANSYS.

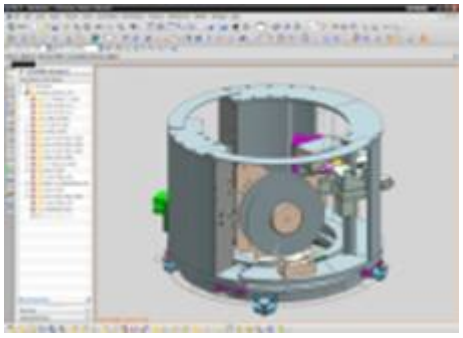


Figure 3. Overlay tool design module

2.4 3D Simulation Module

Figure 4 shows 3D simulation module. This module shows virtually the overlay welding to interested nozzle using the results of overlay design and overlay tool design. The characteristic of simulation module can be plotted the residual stress distribution of the interested region and calculated the overlay working time.

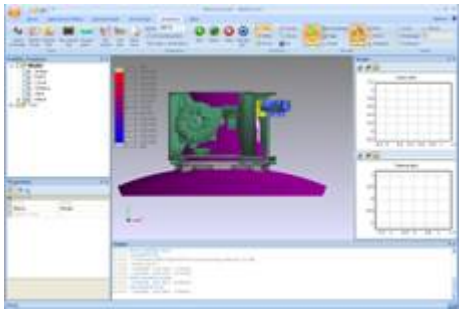


Figure 4. 3D simulation module

3. Conclusions

The development of weld overlay 3D simulation software was completed.

REFERENCES

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