WORK PACKAGE 3: Influence of Geometrical Shape

The objective of this task was to investigate the joint behavior when it is a part of larger structure (e.g., ship). Parameterized Finite Element models were used to simulate different stress-states occurring in the structure due to change of loading conditions, contact and location of the joint in complex structure (Frank et al., 2013a,b, 2015, Lillemäe et al., 2013, 2014,a,b and Lillemäe, 2014, Remes and Fricke, 2014, Romanoff et al., 2015). It was shown that the stress at the welded joint in thin-walled structure is considerably affected by the local geometry and in addition due to the contact in case of stake-welds. It was also shown that the structural behavior in larger scale can be linear at the same time. This means that local models to assess fatigue strength must be analyzed with geometrical non-linearity accounted even though the structural behavior seems linear.

The secondary bending of locally distorted plates is found to dominate over the straightening. The stress gradient affects the slope of the SN-curve on laser stake welds under small scale yielding conditions. Furthermore, the thin plates are very sensitive for the weld notch shape (e.g., undercut). It is shown that low-density foams can be used effectively to increase the fatigue life.

References:


Lillemäe, I., “Fatigue Assessment of Thin Superstructure Decks”, Doctoral Dissertations, Aalto University, School of Engineering, Department of Applied Mechanics, 2014
