

# Intelligent welding clamp design software using computer-aided optimization

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CLAMPIT aims to develop a high-end decision supporting system that helps metalworking SMEs carrying out welding work to increase their efficiency by automatizing clamping design calculations.

A fundamental part of all types of manufacturing technologies is clamping. This operation is critical especially in [welding](#) where the high temperatures and forces due to possible deformation enhance the need even more. The task of specifying clamping positions and forces for welding assemblies are among the most common everyday tasks for welding SMEs. At present preparing the optimal clamping design needs significant human resources both in time and experience. While a simple design requires a couple of hours of an engineer or an experienced technician, a more complex assembly containing 3-5 or more work pieces might require even some days to correctly calculated. The engineer needs to find out the safest possible position of the work pieces that allows joining them by the appropriate welding technique, calculating forces to fix the work pieces and prepare a list of necessary clamping accessory to be used. Based on the internal investigations of welding expert SMEs of the consortium, a small size company is estimated to allocate 50-600 engineer hours a year to prepare clamping designs. At present there is not any commercial product available that could provide a more effective solution for clamping design.

CLAMPIT project aims to develop a high-end decision supporting system that helps metalworking SMEs carrying out welding work to increase their efficiency by automatizing clamping design calculations.

The application assists its users to find the optimum fixture design containing optimal clamping points and forces. In addition it includes a fast and efficient distortion prediction module incorporating LSND technology.

The CLAMPIT system will be a tool to help the competitiveness of SMEs in particular. This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no. 315208.

One of the main advantages of CLAMPIT is the usage of the previously collected and stored experience during designing a welding fixture plan. For this purpose case-based reasoning (CBR) approach is used that helps the welding designers by referencing previous design cases, to make fixturing solution quickly. The newly created cases can be saved back in the case base extending the knowledge of the system. The generated cases can be later converted into a structured format by the assistance of the report generation module.

CLAMPIT includes a module, LSND that can be used independently, together with clamping optimization (CBR), or can be excluded depending on the needs of the user. This module aims to apply thermal shrinkage methods in order to calculate the distortion in welded parts, taking into account the clamping conditions, with the application of specific LSND techniques, allowing for a comparison of results. The module will be able to aid in optimizing clamping conditions for a component, whilst also considering LSND application.

The introduction of CLAMPIT will speed up the methodology of the welding process as the whole clamping design can be done quickly and accurately saving time. The use of case based reasoning (CBR) to design clamping fixtures can be applied in welding workshops to give accurate

information (visually as well) to the welding engineer making the work more efficient. It is more and more accepted that knowledge, experience and expertise can be represented digitally by the use of computer systems in special cases. CLAMPIT supports CAD file handling and CBR to supply the knowledge and experience which could take years of training. It is important to note that the system will not replace but enhance the job of a welding expert giving maximum benefit and reduce the possibility of error.

Provided by CORDIS

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