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Need of Simulations in Welding

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We need two types of simulations in welding,

First to develop/ select WPS that is parameters which will meet Physical test- Tensile, bend, Impact, Micro/ Macro and NDT requirements of the joint. In addition to this we need to also ensure that joint meets the designers' dimensional requirements and does not shrink, distort beyond allowances kept considering feasibility of machining. In some cases such rectification is not possible and we need to select parameters/ sequence or tools/ jigs / fixtures or heating and cooling aids to ensure joint not only will meet Metallurgical properties and NDT requirements but will also be within dimensional requirements. There are few softwares which will simulate material, thickness and joint configuration and may give inputs on WPS parameters but this is like what we developed on our LVD press break by conducting few trials and measuring physical data and then asking LVD to help us to feed in backend of the controller and thus created our own library of aerospace materials and shapes and sizes. Readymade simulation for above is difficult but I understand today with AI and IoT this is being attempted by many Start-ups. Once we begin our journey as we have started on IoT, I am sure we will be able to derive few quick solutions in next couple of months.

Other simulation is used extensively for training and qualification of welders and welding operators. Such simulators are available in the market and one such was made by E&E in the past(I am not sure how many are in use now), these will provide very basic training in improving stability of hand and mainly for stick welding. Now that in aerospace we use mainly TIG where torch just moves and does not come down as there is no consumption of tungsten but with separate hand we feed filler wire, such simulators are very expensive and finally unless welders sees a live arc and fumes and heat, he does not feel the real weld. In MIG also same, wire is continuously fed by machine. So such simulators will suffice we want to have a quick selection of welder or starting a basic training centre but surely not good if we are training for Ti, Al where not only torch but training shield, complex geometries, fixture set up, purge requirements etc cannot be simulated