Based on long time engineering research and dedicated collaborations with industry, the professional welding software, SORPAS, has been developed for simulation of resistance projection and spot welding processes applying the powerful finite element method (FEM). In order to make the software directly usable by engineers and technicians in industry, all of the important parameters in resistance welding are considered and automatically implemented into the software. With the specially designed graphic user interface for Windows, engineers (even without prior knowledge of FEM) can quickly learn and easily operate and utilize the software. With the user-friendly facilities for flexible geometric design of work pieces and electrodes as well as process parameter settings similar to real machine parameter settings, the software has been readily applied in industry for supporting product development and process optimization. After simulation, the dynamic process parameters are graphically displayed. The distributions of temperature, current, stress and deformation in the materials are displayed in color, which can be animated like slow-motion video. The software has been extensively verified and today applied in industries including automotive, electronics and other metal processing industries as well as welding equipment manufacturers.