Contribution ID: **103** Type: **not specified**

Analysis of resistance of spot welding process data in the automotive industry via functional clustering techniques

Tuesday, 14 September 2021 12:40 (20 minutes)

Quality evaluation of resistance spot welding (RSW) joints of metal sheets in the automobile sector is generally dependent on expensive and time-consuming offline testing, which are impracticable in full-scale manufacturing on a vast scale. A great opportunity to face this problem is the increasing digitization in the industry 4.0 framework, which makes on-line measurements of process parameters available for every joint manufactured. Among possible parameters that can be monitored, the so-called dynamic resistance curve (DRC) is considered as the spot welds' technological signature. This work aims to demonstrate in this context the potential and practical relevance of clustering algorithms to functional data, i.e., data represented by curves varying over a continuum. The objective is to partition DRCs into homogenous groups related to spot welds with common mechanical and metallurgical characteristics. The functional data approach has the advantage that it does not need feature extraction, which is arbitrary and problem specific.
We discuss the most promising functional clustering techniques and apply them to a real-case study on DRCs acquired during lab tests at Centro Ricerche Fiat. Through the functional clustering approach, we found that the partitions obtained appear to be related to the electrodes wear status, which is surmised to affect the final quality of the RSW joint. R code and the ICOSAF project data are made available at https://github.com/unina-sfere/funclustRSW/, where we provide also an essential tutorial on how to implement the proposed clustering algorithms.

Keywords

functional clustering, resistance spot welding, industry 4.0

Special/invited session

Primary authors: CAPEZZA, Christian (University of Naples Federico II); CENTOFANTI, Fabio (University of Naples Federico II); LEPORE, Antonio (University of Naples Federico II); PALUMBO, Biagio (University of Naples Federico II)

Presenter: CAPEZZA, Christian (University of Naples Federico II)

Session Classification: Quality 2

Track Classification: Quality