Adaptive Process Implementation in Additive Manufacturing Technologies by Artificial Intelligence
Organisation Legal Name: ARÇELİK A.Ş. (in native language)
Organization Type: IND
Country: Turkey (TR)
Website: www.arcelik.com.tr
http://www.arcelikglobal.com/en
Year of Establishment: 1955, Headquarters: Istanbul, Turkey

Organisation description:
Having operations in durable consumer goods industry with production, marketing and after-sales services, Arçelik offers products and services around the world with its 30,000 employees, 23 different production facilities in 8 countries (Turkey, Romania, Russia, China, South Africa, India and Pakistan), its 35 sales and marketing companies in 33 countries all over the world and its 12 brands serving products and services in more than 146 countries.

The Company’s vision is “Respects the Globe, Respected Globally”. As one of the foremost companies in KOÇ Group and Turkish private industry, Arçelik, founded in 1955, has always been the leader in Turkish private sector with its efforts for industrial development. Today, Arçelik Group is the third largest company in home appliances sector in terms of total sales in Europe.

There are over 1500 R&D employees in R&D Centers located in Global. Arçelik has 17 R&D units located in six countries. Besides 14 R&D and Design Centres in Turkey, Arçelik has R&D offices in Cambridge - UK, Taiwan and Wuxi - China. In addition to its expertise in its principal product areas, Arçelik has also consciously developed its capability in the engineering disciplines that underpin Arçelik’s products and their functions, including thermodynamics, fluid mechanics, vibration and acoustics, advanced material technologies, sensors, IoT (Internet of things) and computer assisted design and engineering. Arçelik maintains a strong focus on research and development and believes its ability to deliver innovative products is key to its success. Arçelik is proud to be selected the “Best R&D Centre” of Turkey by the Ministry of Science, Industry, and Technology consecutively in 2016 and 2017 based on achievements and figures.

Arçelik attributes its success to its significant investments in R&D and technology. Providing customers with technologically innovative products is a key aspect of Arçelik’s strategy to strengthen its brands and its global presence. In particular, Arçelik has leveraged product specific R&D across its segments in order to further drive innovation.
PROPOSAL INTRODUCTION (I)

Vision: main project goal

Selective Laser Sintering (SLS) is one of the widely used Additive Manufacturing (AM) technique which uses laser as the power source to sinter the powdered material and with binding the material together, aims to build a solid structure.

During the SLS process, virgin powder and overflow + used powder mixed before feeding to the system to perform the sintering process. However, the mixing ratio cannot be detected and classified during the SLS process and manufacturing processes’ parameter adjustment cannot be controlled during the operation. Its critical to automatically detect and measure the mixing ratio of the virgin and overflow + used material powders by a suitable measurement methodology before and during the manufacturing process. Hence, the best fit categorization can be performed and parameter adjustment can be automatically observed during the process for mitigating defects such as warping that can fail the end-product, minimize time and material waste. Developing a suitable visual control application by using AI, layer based control or classification system with instant adjustment of optimum process condition, can help to overcome the quality problems & weaknesses of the final product with resulting great saving of the time, energy and printing material. (As Is And To Be scenarios of the project can be find in the upcoming sections)

Motivation: why the project is necessary

The Project is important in the sense of minimizing the possible defects, cracking, quality problems of the manufactured parts with saving time, energy and material itself. More controlled and integrated system will be created.

Content: which are the developments to be made in the project

Configuring a best-fit control application or classification system by using AI with providing feedback to instant adjustment of the optimum process condition during the SLS method. Defining the best examination methodology of the mixed material is needed for the categorization. Material properties need to be studied and best methodology and related inspection system need to be determined (humidity of the material, viscosity characterization, weight-based analysis for virgin and overflow + used powder material and etc). Sensor system, thermal camera and etc. related detection system and integration need to be performed to be sure that developed system and process is matched.
As Is Scenario

Virgin Powder
Overflow + used Powder

SLS Process

Mixture
Final Product

Different Mixture Ratios

Category A ? = \( \frac{\text{virgin powder}}{\text{overflow + used powder}} \) = %20
Category B ? = \( \frac{\text{virgin powder}}{\text{overflow + used powder}} \) = %30
Category C ? = \( \frac{\text{virgin powder}}{\text{overflow + used powder}} \) = %40

- Quality problem
- Loss of time and used material

\( \rightarrow \) Result in unsatisfied production and result in waste

To Be Scenario

New Measurement Method before printing

SLS Process

Mixture

\( \% X = \% \frac{\text{virgin powder}}{\text{overflow + used powder}} \)

Program A: process parameters optimisation Acc. Category A
Program B: process parameters optimisation Acc. Category B
Program C: process parameters optimisation Acc. Category C

Categorization and in-situ control

Detection

Category A = \( \% \frac{\text{virgin powder}}{\text{overflow + used powder}} \)
Category B = \( \% \frac{\text{virgin powder}}{\text{overflow + used powder}} \)
Category C = \( \% \frac{\text{virgin powder}}{\text{overflow + used powder}} \)

Final Product

Satisfied production

\( \rightarrow \) Result in satisfied production
Expected outcome: descriptions of the results to be obtained in the project

- Decreasing the quality problems of the final product
- Resulting great saving of the time, energy and printing material (powder)
- Mixing ratio of the virgin and overflow + used powder can be detected and classified during the manufacturing and best-fit program is selected accordingly. Thus, results in more controlled and traceable process.
- Instant adjustment of the optimum process parameters

Dissemination potential: Pilot study of the process can be performed at Arcelik Cayirova Location (Garage) and can be disseminated to all other SLS processes and sectors which have similar methodologies.

Impacts: what will be the expected market impact of the project

- Saving of the material, time and energy with more controlled and traceable operation
- Correct prototype in first printing attempt
- No more trial & error to optimize SLS process parameters
- AI powered decision support system
PARTNERS

Current Consortium: list of partners already involved in the project

Arcelik: Will be positioned as use case provider and pilot study will be performed at Arcelik. Arcelik will also provide information related with the process, data and involve in the development and integration phases of the project with defining the current situations, needs and provide feedbacks related with the development.

Partner search: type of partner searched and countries of origin (if necessary).

• Partners needed for material property classification and study (could be University, Research Center)

• Partners needed for the development of sensor based/ camera based system to categorize the measured material (could be University, Research Center, Big or Small Sized company working on sensor systems or camera)

• Partners maybe needed for the communication and integration of the developed system to make the system and process match each other (could be University, Research Center, Big or Small Sized company)
CONTACT INFO

Contact info: of the person coordinating the project proposal

Please do not hesitate to get contact with us for discussing more details of the project...

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