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Corresponding author: Sejin Kwon
e-mail of corresponding author: trumpet@kaist.ac.kr
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Title

Proposal of Aerospace-informatics by Design of Ramjet Inlet Using Machine Learning

Authors

*Seungho Lee [1], Sunho Lee [2], Jaehyuk Huh [3], Sejin Kwon [4]**

** Corresponding author*
[1] Department of Aerospace Engineering, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, 34141, Republic of Korea, myshlee520@kaist.ac.kr
[2] School of Computing, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, 34141, Republic of Korea, myshlee417@casys.kaist.ac.kr
[3] School of Computing, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, 34141, Republic of Korea, jhhuh@casys.kaist.ac.kr
[4] Department of Aerospace Engineering, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, 34141, Republic of Korea, trumpet@kaist.ac.kr

Abstract

In this research, aerospace-informatics was proposed by design of ramjet inlet using machine learning. Aerospace engineering has been rapidly grown and has produced unprocessed massive data. Informatics of computer science has been widely applied to various fields such as biology leading to bioinformatics. Therefore, aerospace-informatics was suggested as interdisciplinary research between aerospace engineering and computer science. Ramjet inlet consisted of supersonic diffuser, diffuser throat, and subsonic diffuser. Inlet variables included inlet radius, inlet length, inlet support thickness, subsonic diffuser exit width, subsonic diffuser support internal radius, subsonic diffuser support length, capture area radius, nose cone half angle, oblique shock half angle, cowl lip arc diameter, cowl lip arc angle, cowl angle, diffuser throat width, and subsonic diffuser width angle. In order to accomplish effective and efficient combustion, high combustion chamber pressure obtained by inlet with high pressure recovery is generally required. Maximum values are acquired in critical mode without air mass flow rate loss in subcritical mode and pressure recovery loss in supercritical mode. Iteration to examine attainment of critical mode according to combustion chamber pressure for every shape is immoderate, so machine learning was utilized for low cost of time. Furthermore, the model of machine learning enhanced over baselines such as linear regression or two linear model was investigated for high accuracy to avoid catastrophe in aerospace engineering. The model was organized in three steps. First, maximum combustion chamber pressure according to shape was predicted by artificial neural network. Second, shape was discriminated whether it is feasible or not by binary classification with techniques such as support vector machine or logistic regression. Third, heuristic search was conducted with weighted value from above-mentioned two steps. As a result, the shape with high maximum combustion chamber pressure and high feasibility was extracted.

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