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Airfoil Shape Optimization using Deep Q - Network SIDDHARTH ROUT, Department of Mechanical Engineering, Indian Institute of Technology Madras, Chennai, India, PROF. CHAO-AN LIN, Department of Power Mechanical Engineering, National Tsing Hua University, Hsinchu, Taiwan — The feasibility of using reinforcement learning for airfoil shape optimization is explored. Deep Q-Network (DQN) is used over Markov's decision process to find the optimal shape by learning the best changes to the initial shape for achieving the required goal. The airfoil profile is generated using Bezier control points to reduce the number of control variables. The changes in position of control points is restricted to the direction normal to the chordline so as to reduce the complexity of optimization. The process is designed as a search for an episode of change done to each control point of a profile. The DQN essentially learns the episode of best changes by updating the temporal difference of Bellman Optimality Equation. The drag and lift coefficients are calculated from the distribution of pressure coefficient along the profile computed using XFoil potential flow solver. These coefficients are used to give reward to every change during learning process where the ultimate aim stands to maximize the cumulate reward of an episode.

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