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Submission ID: 1372

Title: Optimal Terrain Following Algorithm for Fighter Jets via Reinforcement Learning

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Abstract: In certain missions, fighter jets are required to operate closely to the terrain due to tactical considerations. Especially at night, when visibility is reduced and reliance on visual cues are limited. The need for precision in motion planning becomes even more critical. This study aims to address this critical need for precision in such scenarios. Within this context, a reinforcement learning supported algorithm capable of terrain following with low ground clearance for fighter jets is developed, and simulations are conducted using high fidelity F-16 flight dynamics model. A primitive-based motion library is leveraged to generate a dynamically feasible, obstacle-free and shortest trajectory. In contrast to earlier studies, these primitive-based motions are constructed through the classification of motions generated by reinforcement learning which uses continuous control input sets to create trajectories. To minimize the number of motions during classification, rewards of reinforcement learning are shaped for trimmed flight, meaning that the least agility and the fewest sequential maneuvers possible. Subsequent to establishing the primitive-based motion library, the obstacle-free trajectory is generated in two stages. Principally, the shortest geometric path (without any dynamic considerations) is generated using the Theta* algorithm, which generates shorter paths than both A* and Field D*. Afterwards, the most overlapped dynamically feasible trajectory to this geometric path is optimized using primitive motions created by reinforcement learning. Consequently, it has been observed that the proposed method shows promise for such problems, as it generates dynamically feasible and shortest trajectories more quickly compared to previous studies.

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