

Control of a Three Degree of Freedom Quadcopter Stand Using Linear Quadratic Integral Based on the Differential Game Theory

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Abstract—In this paper, a quadcopter stand with three degrees of freedom was controlled using game theory-based control. The first player tracks a desired input, and the second player creates a disturbance in the tracking of the first player to cause an error in the tracking. The move is chosen using the Nash equilibrium, which presupposes that the other player made the worst move.. In addition to being resistant to input interruptions, this method may also be resilient to modeling system uncertainty. This method evaluated the performance through simulation in the Simulink environment and implementation on a three-degree-of-freedom stand.

Index Terms—Quadcopter, Differential Game, Game Theory, Nash Equilibrium, Three Degree of Freedom Stand, Model Base Design, Linear Quadratic Regulator

I. INTRODUCTION

Quadcopter is a type of helicopter with four rotors.

II. DIFFERENTIAL GAME

Differential games are a series of problems that arise while examining and simulating dynamic systems in game theory. Differential equations are used to simulate how a state variable or set of state variables changes over time.

A. An introduction to the differential game

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Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, ac, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

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Number equations consecutively. To make your equations more compact, you may use the solidus (/), the exp function, or appropriate exponents. Italicize Roman symbols for quantities and variables, but not Greek symbols. Use a long dash rather than a hyphen for a minus sign. Punctuate

equations with commas or periods when they are part of a sentence, as in:

$$a + b = \gamma \quad (1)$$

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Please use “soft” (e.g., `\eqref{Eq}`) cross references instead of “hard” references (e.g., (1)). That will make it possible to combine sections, add equations, or change the order of figures or citations without having to go through the file line by line.

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- The word “data” is plural, not singular.
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- Be aware of the different meanings of the homophones “affect” and “effect”, “complement” and “compliment”, “discreet” and “discrete”, “principal” and “principle”.
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- There is no period after the “et” in the Latin abbreviation “et al.”.
- The abbreviation “i.e.” means “that is”, and the abbreviation “e.g.” means “for example”.

An excellent style manual for science writers is [7].

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H. *Figures and Tables*

a) *Positioning Figures and Tables:* Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span

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TABLE I
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| Table Head | Table Column Head | | |
|------------|------------------------------|----------------|----------------|
| | <i>Table column subhead</i> | <i>Subhead</i> | <i>Subhead</i> |
| copy | More table copy ^a | | |

^aSample of a Table footnote.



Fig. 1. Example of a figure caption.

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ACKNOWLEDGMENT

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