The review of bachelor's Final Qualification thesis of Computer Technologies and systems department of Saint Petersburg State University by Artemiy Valerievich Ivanov

Synthesis of optimal trajectories for a nonlinear fourth-order system

Artemiy Valerievich in his thesis analyses the problem of controlled object movement from the preset original position into coordinate origin with pre-defined course angle at the endpoint in minimum time. Object motion is described by a nonlinear system of ordinary differential equations of the fourth degree.

The problem of development of controlled object from the preset initial position to origin of coordinates with the preset value of course angle in a final point for the minimum time is reviewed in the paper. Object motion is described by a nonlinear system of ordinary differential equations of the fourth degree. It should be noted that similar systems were repeatedly analyzed in the past. A game approach, so-called "homicidal shauffeur" game was most commonly used. In the proposed paper an object motion research is carried out using a "classical" method of optimum control theory–a maximum principle. Distinction of the statement of the problem under consideration, from the researched and solved previously, is the restriction on course angle and speed of controlled object values. Besides additional restrictions are imposed on these movement parameters in finite time instant. It is assumed that an optimum control and, therefore, optimum motion trajectory exist. The special case of object motion where the stated problem is solved by a single switching of course angle control. In the course of his research, the student has formulated and proved the theorem on the number of switch over points of speed control. As the problem of trajectory synthesis meeting the maximum principle cannot be solved analytically Artemiy Valerievich has developed a numerical algorithm for constructing such trajectories.

It should be noted that the thesis was prepared at high mathematical level and serves as basis of the presentation that Artemiy Valerievich made at the Control Processes and Stability (CPS'21) conference.

With regard to all mentioned above, bachelor's thesis by Artemiy Valerievich deserves an excellent mark.

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