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Modeling of Motion of an Automatically Controlled Beam-Riding Guided Missile in Terms of the Maggi Equations

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The paper presents the process of modeling and numerical simulation of a flight of a guided ground-to-air missile. The term "beam guidance" describes the method applied, which is a kind of the command-to-line-of-sight guidance with the guide beam employed. This method is most frequently used in the anti-aircraft missile guidance. A variety of mathematical methods have been employed in the course of generating a model useful in solving the problems appearing. However, in the available literature the Authors did not find any approach in which the Maggi equations had been used thou they have been known as a perfect tool for modeling, especially when dealing with non-holonomic constraints.

I. Introduction

MANY research centers all over the world have been conducting investigations into control and guidance onto a target of different kinds of missiles profiles, control surfaces A variety of mathematical methods have been employed in the course of generating a model useful in solving the problems appearing. However, in the available literature the Authors did not find any approach in which the Maggi equations had been used thou they have been known as a perfect tool for modeling, especially when dealing with non-holonomic constraints. One of the Authors has undertaken an attempt at solving those problems in her Ph.D. thesis under supervision of Professor J. Maryniak[7].

The paper presents the process of modeling and numerical simulation of a flight of a guided ground-to-air missile. The term "beam guidance" describes the method applied, which is a kind of the command-to-line-of-sight guidance with the guide beam employed. This method is most frequently used in the anti-aircraft missile guidance.

In the considered case the missile flights along a curvilinear trajectory being maintained on the line joining the control point with the target (Fig.1). That is a kind of three-point guidance method since the line of sight passes through the following three points: control point, missile and target.
The method consists in the fact that the target tracking radar emits towards the target the so-called zone of uniform signals, within which the actual kinematic parameters of the missile are equal to the preset ones determined by the motion of the beam tracking the maneuvering target. The missile should never leave this zone. The missile carries the equipment measuring its deviation from the uniform signal zone. Having measured a deviation the signals are generated and send to the missile control surface so that it can return to the predetermined trajectory.

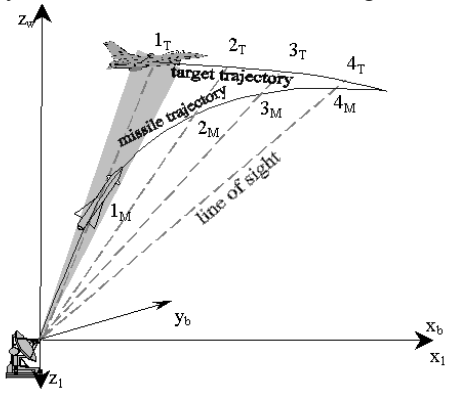

Figure 1 A Beam-riding guidance of a missile

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