

A Low Cost Solution for the Navigation Problem of Wheeled Mobile Robots in Intelligent Space

Radu-Emil Precup^(*), Stefan Preitl^(*), Csongor Szabó^(*), Péter Korondi^(**), Péter Szemes^(***)

^(*) “Politehnica” University of Timisoara, Department of Automation and Industrial Informatics

Bd. V. Parvan 2, RO-300223 Timisoara, Romania

e-mail: rprecup@aut.utt.ro, spreitl@aut.utt.ro, zobertke@home.ro

^(**) Budapest University of Technology and Economics, Integrated Intelligent Systems Laboratory

P.O. Box 91, H-1521 Budapest, Hungary, e-mail: korondi@elektro.get.bme.hu

^(***) University of Tokyo, Institute of Industrial Science

4-6-1 Komaba Meguro-ku, Tokyo, Japan, e-mail: szemes@vss.iis.u-tokyo.ac.jp

Abstract

The paper develops low-cost PI-fuzzy controllers as tracking controllers for nonholonomic mobile robots in Intelligent Space. A simplified dynamic model of the wheeled mobile robots with two degrees of freedom is first derived. The control system structure is a cascade one, which contains two control loops for controlling the forward velocity and the angle between the heading direction and the x-axis. Our PI-fuzzy controllers are a special case of two-degree-of-freedom controllers. A development method for PI-fuzzy controllers is next proposed. The method is based on the Extended Symmetrical Optimum method applied to the basic linear PI controllers and on the modal equivalence principle. The paper also contains the computation of sensitivity models with respect to the parametric variations of the controlled plant. The PI-fuzzy controllers are validated by simulation results.

Acknowledgements

The support from two CNCSIS grants – the A grants with the numbers 189 and 190 in 2004 – and from the cooperation between Budapest University of Technology and Economics and “Politehnica” University of Timisoara in the framework of the Hungarian-Romanian Intergovernmental Science & Technology Cooperation Program is acknowledged.

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