

## PLNÝ NÁZEV VYBRANÉHO PŘÍSPĚVKU TŘÍDY A

### Mapping Based Algorithm for Large-Scale Computation of Quasi-Polynomial Zeros

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Předkladatel výsledku do Pilíře II.:

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Podíl předkladatele na výsledku: **100 %**

#### **Anotace dle RIV:**

A method for computing all zeros of a retarded quasi-polynomial that are located in a large region of the complex plane is presented. The method is based on mapping the quasi-polynomial and on utilizing asymptotic properties of the chains of zeros. First, the asymptotic exponentials of the chains are determined based on the distribution diagram of the quasi-polynomial. Secondly, large regions free of zeros are defined. Finally, the zeros are located as the intersection points of the zero-level curves of the real and imaginary parts of the quasi-polynomial, which are evaluated over the areas of the region outside those free of zeros.

#### **Odůvodnění předkladatele:**

The article presents an original method for computing arbitrarily large set of zeros of a retarded quasi-polynomial located in a given region of complex plane. The method is based on mapping the quasi-polynomial and on utilizing asymptotic properties of the chains of zeros. The uniqueness of the algorithm is in the ability to compute effectively a large number of roots (hundreds and even thousands) of a time delay system. The presented algorithm is one of very few algorithms that can perform the given computationally demanding task. The algorithm is particularly important for analysis of dominant dynamical modes and the stability analysis of time delay systems, which are infinite dimensional. The design and implementation of the algorithm enabled the authors to achieve a number of subsequent research results in the spectral analysis and synthesis of time delay systems and resulted in a rich international collaboration (e.g. with Prof. W. Michiels, K.U. Leuven, Belgium, Prof. N. Olgac, University of Connecticut, US and Prof. D. Henrion, LAAS CNRS Toulouse - with 7 joint journal publications indexed at WOS where the algorithm was directly involved). The article and the algorithm have also achieved high impact and recognition in time delay system community (27 citation records in WOS and 41 in Scopus). The research results presented in the article have fully been performed in the research group of Prof. Pavel Zítek at CTU in Prague. Based on the distinguished results achieved by the group in the spectral analysis of time delay systems, the group was entrusted to organise the prestigious 9th IFAC Workshop on Time Delay Systems, June 7 - 9, 2010, at CTU in Prague. The research results were also acknowledged by CTU in Prague Rector's Award for distinguished research results in 2009.

#### **Odůvodnění panelu:**

Excellent theoretical result with good application potential, published in a leading journal, good international impact apparent from many citations worldwide.