

Dissertations

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František Zuzák: Compact Standardized Shape Description

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Summary. This dissertation at first presents a survey of the shape descriptors obtainable in the spatial domain of the image with respect to the boundary representation of the analyzed shape. It discusses properties of these descriptors and it suggests the methods of their computations too.

Secondly, it deals with the problem of the transformation invariant shape description based on the analysis of the boundary coordinate runs. This resulted in the definition of standardized form and orientation of shape.

Thirdly, this work introduces an original approach to the shape description based on standardized shape boundary analysis in the complex plane. An approximation of standardized shape is manifested too. Then a calculation of a difference of two shapes is shown and some of the boundary curve complexity factors are proposed. The main moment is a design of the compact shape description using the harmonic signatures allowing the quasi-reconstruction of the original shape.

Finally, it presents a variety of applications with emphasis to the computer aided tribo-diagnostics, the achieved results are depicted on suitable examples, the acquisition of the work is summarized and related challenges suggested.

**Jan Jára: Tone Quality Classification by Artificial Neuronal Nets
– NEUROHARM Method**

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Summary. This document dissertates with an inter-discipline application of a theory of artificial neural networks, signal processing, acoustics and music theory for the diagnosis of objects on the basis of their acoustic behaviour. The developed method NEUROHARM has two main fields of application.

The first field is music which was its inspiration source. Based on the recordings of separate tones of a musical instrument with classified quality the method NEUROHARM can be relatively successful in the tone quality classification. This method can be used in teaching music or in materialization of tone quality classification. In this field the method was tested on musical instruments bombardon and b-trumpet.

The second field of the NEUROHARM method application is industry, especially acoustic operation diagnostics of rotating machines. Also here it is possible, based on quality-classified recordings of the sounds of a machine in various states, to diagnose the state of the machine based on its sounds. Tests were carried out on a car gearbox. The system using the method NEUROHARM specified not only the actual speed and loading but specified even the lubricant used with an error below 0.2%.

Another field of application of this method is classification of data e. g. for easier manipulation in sound database. A necessary condition for application of this method is making a record of an acoustic signal or, more generally, of a vibration signal of the subject in question together with classification of its quality. The signal must have qualities corresponding to characteristics of the tone of a musical instrument, i. e. dominant harmonic frequencies that are constant within the time of recording of the studied state, their mutual relation and relation to other non-harmonic frequencies of such signal carry information on the state of the studied object.