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TOPIC OF RESEARCH : DEVELOPMENT OF OPTIMAL ALGORITHMS FOR ROBUST  
AUDIO WATERMARKING.  
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### **ABSTRACT**

Audio watermarking involves embedding a sequence of copyright data as supplementary information into an audio file. It has numerous applications, most of which have not yet been fully exploited. Moreover in the present era of internet safety, security and privacy have become more concern, due to fast transmission of data and deeper effects which are unrecoverable. This phenomenon led to evolve more robust watermarking techniques. That is the motivation of this research.

In this thesis, the problem of digital watermarking in audios for protection of copyright and deterring/preventing piracy is addressed. Transform domain with nature-based optimization technique Firefly Algorithm audio watermarking schemes based on , Schur Decomposition, Dither Modulation (DM), Quantization Index Modulation (QIM) and Singular Value Decomposition (SVD) are developed with improved imperceptibility and robustness. SVD based watermarking scheme inherently robust to different signal processing attacks is also proposed and developed.

The drawbacks of current watermarking schemes that are traditionally based on Wavelet Transform (WT) and SVD are analyzed. The first focus is on developing improved Schur Decomposition based audio watermarking schemes which uses the Dither Modulation and Quantization Index Modulation for watermark embedding. The Schur coefficients are selected based on their robustness to embed watermark bit and experiments are conducted to

check robustness of proposed method.

The second focus is on development of robust scheme for which SVD and Firefly Algorithm is used. The proposed SVD based audio watermarking schemes use Firefly Algorithm to optimize quantization parameter. Firefly Algorithm is used to optimise the modified host audio to achieve the highest possible robustness and transparency. This approach can significantly increase the quality of watermarked audio and provide more robustness to the embedded watermark against various attacks such as noise, resampling, filtering attacks.

The third focus is on developing audio watermarking scheme inherently robust to different signal processing attacks. A robust digital audio watermarking technique has been proposed utilizing firefly algorithm. To validate the performance of proposed approach extensive experiments are conducted on four types of audio formats considering Normalized Correlation and Bit Error Rate as quality parameters. The robustness of proposed approach has also been tested by applying different signal processing attacks. The results indicate the superiority of proposed approach against other Sucher Decomposition and Dither Modulation based techniques.

Extensive experiments are carried out to evaluate and compare the proposed schemes with the state of the art schemes.

The present thesis is not only comprehensive compilation of the topic chosen, i.e. “Development of Optimal Algorithm for Robust Audio Watermarking” rather it has its own nobleness and contribution. Besides this there can also be an important text for reference whosoever like to explore further this subject matter through research.