

## EVALUATION OF CUSTOM VIRTUAL MACHINE INSTRUCTION SET EMULATOR

Jozef KOSTELANSKÝ, Lubomír DEDERA

**Abstract:** The main goal of the article is to evaluate performance characteristics of a custom virtual machine instruction set emulator. The instruction set has been designed as part of research aimed at utilization of custom virtual machines in the area of obfuscation techniques for software protection and malware detection, with the aim to efficiently implement the particular algorithm (CRC16). In the paper we compare performance characteristics of two implementations of the CRC16 algorithm – in the emulated custom virtual machine instruction set and the direct C-to-x86-compiled executable. The aim is to show that the emulation process of such a simple virtual machine has only minor influence on execution time in comparison with the C-to-x86-compiled code.

**Keywords:** Instruction set; Virtual machine; Performance; Compilers; Time measurements.

## SIMULATION ANALYSIS OF PLANETARY TRANSMISSIONS IN MATLAB ENVIRONMENT

Matúš RIEČIČIAR, Peter DROPPA

**Abstract:** At present time three main widespread methods of planetary gearboxes analysis are used – analytical calculation, practical tests and simulations. This paper deals with verification of the Simscape driveline module of the Matlab software as a tool of vehicle transmission and driveline designing. Different parameters results of analytical computing and Simscape simulations output values are compared in this paper. Deviations of these values turned out to be insignificant and therefore Simscape module proved to be applicable, usable, cost and time reducing and very useful in transmissions designing process.

**Keywords:** Planetary gearbox; Transmission; Simulation; Simscape; Driveline.

## PERFORMANCE EVALUATION OF DOWNLINK SATELLITE BROADCAST STREAM UNDER RAINY CONDITIONS IN A LABORATORY-CONTROLLED ENVIRONMENT

Hung NGUYEN MANH, Marie RICHTEROVÁ, Tomáš BŘINČIL

**Abstract:** The attenuation induced by rain greatly impacts the performance in the satellite communication at Ku band. In fact, it is very challenging to measure parameters of the satellite channel under rainy conditions in the laboratory environment. Due to the complex in terms of design, development, management and maintenance of the system and the dynamic characteristics of the satellite channel with respect to operators utilizing this frequency band, it becomes essential to study the key effects and causes of the signal attenuation. In order to have the accurate evaluation in the satellite channel, end-to-end performance of the system based on a description of the standard document under raining conditions was modelled by the Rician distribution and K-factor. The average bit error rate used for the performance evaluation of the system by the experimental test. Obtained results in the satellite channel condition are evaluated, analyzed and discussed. Moreover, specific future planned work is also mentioned in the article.

**Keywords:** Digital Broadcast Video; Sum-of-sinusoids principle; Rician distribution; Rain attenuation; Channel impairments.

## OPTIMIZATION OF ULTRASONIC CUTTING TOOL GEOMETRY

Anton MYDLIAR

**Abstract:** This article solves the optimization of the ultrasonic cutting tool geometry. The parameterizable model of ultrasonic cutting tool was created in finite element (FE) software Ansys. The eigenfrequencies and modal shapes were extracted by modal analysis. Harmonic analysis showed the improvement of the amplitudes and the mechanical stresses of optimized ultrasonic tool. The results and measurements are summarized in the conclusion.

**Keywords:** Optimization; Eigenfrequency; APDL; Ultrasound; Cutting tool.

## FORMAL MODEL OF DECOMPOSITION AND MAPPING IN ACCELERATED CLUSTER ARCHITECTURE

Miloš OČKAY, Ľubomír DEDERA

**Abstract:** Accelerated Cluster is currently the core architecture that drives computing performance in HPC applications. Graphic accelerators push the boundaries of the established parallel cluster architecture in a significant way, and in the near future, it will enable the achievement of exaflops milestone in HPC systems. Presented paper outlines basic elements of accelerated cluster architecture. It also explains decomposition and mapping in multistage architecture, using the data and task parallelism. Presented formal model describes the decomposition on all stages, allowing more efficient mapping and achieving an accelerated solution in a complex problem.

**Keywords:** Computer cluster; GPU; Accelerator; Parallel; Decomposition; Mapping.

## CYBER SECURITY STATE IN REAL ENVIRONMENT

Martin DROPPA, Marcel HARAKAE

**Abstract:** The purpose of this document is to give an insight into the wide area of world of cyber security and state of the cyber security in AFA (Armed Forces Academy in Liptovský Mikuláš) environment. All IT studies confirm that cyber attacks are increasing annually. Few years ago, as many as 70 % of companies worldwide were affected and loss probability of economic value was € 190 billion. Preventing attacks that are trying to penetrate the internal network through firewalls, and the lack of user awareness, is not a matter of choice but of necessity. Are the companies of 21<sup>st</sup> century ready for cybercrime? In the end, the findings from the state of cyber security at AFA are described. Based on a simple analysis of the situation in the AFA environment, the proposed recommendations, measures, methods of eliminating cyber attacks are briefly described.

**Keywords:** Detection; Threat; Assessment; Malware; Attack; Network; Vulnerability; Exploits.

## FUNDAMENTALS OF STATIC MALWARE ANALYSIS: PRINCIPLES, METHODS AND TOOLS

Andrej FEDÁK, Jozef ŠTULRAJTER

**Abstract:** Nowadays, the security of all systems connected to the public network is severely tested. Most users try to protect themselves against many abusive practices by using many security tools to keep their privacy safe. Information technology security involves many branches that address the prevention and protection against malicious software. One of those branches is the analysis of malicious files, specifically we will focus on the static analysis of malware. In static analysis, a suspicious sample is not executed and observed as in dynamic analysis, but many tools and methods are used to extract meaningful character strings from sample, data from the header of executable file format, information about the type of compression, the type of compiler used to create the file, and last but not least the application code. This work provides an initial insight into the complex subject of static analysis.

**Keywords:** Forensic analysis; Static analysis; Malware; Portable executable; String; PE header; Extractor; Obfuscation; Compression.