

# Contents

## Preface

### **Session 1 Condition monitoring, sensors and automation**

|  |    |
|--|----|
| A novel system layout for extended functionality of mobile machines<br><i>T Stamm von Baumgarten, B Grösbrink, T Lang, H-H Harms</i>   | 13 |
| Utilization of RFID and pressure sensor for intelligent hose condition monitoring<br><i>A Aarnio, L Elo, E Mäkinen, L Ukkonen, M Soini, L Sydänheimo, M Vilenius, M Kivikovski</i> | 27 |
| Condition monitoring and fault diagnosis for vane pumps using flow ripple measurement<br><i>M Yang, K Edge, N Johnston</i>   | 43 |

### **Session 2 System modelling**

|  |     |
|--|-----|
| Recursive generalised neural networks (RGNN) for the modeling of a load sensing pump<br><i>T Wiens, R Burton, G Schoenau, D Bitner</i> | 59  |
| An open-source Modelica library of fluid power models<br><i>C Paredis</i>  | 77  |
| Modelling pipeline dynamics using optimized finite element model<br><i>K Sanada</i>  | 93  |
| Modelling of hydraulics and mechanics of a mobile machine<br><i>A Vuohijoki, M Hyvönen, K Huhtala, M Vilenius</i>                      | 109 |

### **Session 3 Control I**

|  |     |
|--|-----|
| Synchronous motion control of thrust system of pipe jacking shield machine<br><i>H Shi, G Gong, H Yang</i>                       | 125 |
| Improvement in feedback signal quality for water hydraulic manipulator<br><i>A Muhammad, J Mattila, T Virvalo, M Vilenius</i>    | 137 |
| Robust control performance comparisons for a water hydraulic servo motor system<br><i>K Ito, S Ikeo, H Takahashi, N Kanamori</i> | 153 |

### **Session 4 High performance valves I**

|   |     |
|---|-----|
| Magnetorheological (MR) damper with a fast response time<br><i>J Kostamo, E Kostamo, J Kajaste, M Pietola</i> | 169 |
| Simulation of Piezoelectric high-speed digital valves<br><i>X Ouyang, H Yang, H Jiang, N Johnston</i>         | 185 |
| A reduced-order model for a poppet-type relief valve<br><i>N Manring</i>                                      | 201 |

## **Session 5 Pneumatics**

|   |     |
|---|-----|
| Applicability of servopneumatic positioning systems for high loads<br><i>Y Ernesto A Mendoza, L Gonçalves de Oliveira, V Juliano De Negri</i> | 219 |
| Experimental assessment of a free elastic-piston engine compressor with separated combustion chamber<br><i>J Riofrío, E Barth</i>             | 235 |
| Modelling and control of a free liquid-piston engine compressor<br><i>C Yong, E Barth, J Riofrío</i>  | 249 |

## **Session 6 Efficient and intelligent systems**

|  |     |
|--|-----|
| The Center for Compact and Efficient Fluid Power<br><i>K Stelson</i>   | 265 |
| Towards intelligent mobile machines - GIM research<br><i>K Huhtala, J Suomela, M Vilenius, A Halme</i>   | 277 |
| Efficiency study of an excavator hydraulic system based on displacement-controlled actuators<br><i>C Williamson, J Zimmerman, M Ivantysynova</i> | 293 |
| New electro-hydraulic control systems for mobile machinery<br><i>R Finzel, S Helduser</i>  | 311 |

## **Session 7 Pumps and noise**

|   |     |
|---|-----|
| Active systems for noise reduction and efficiency improvement of axial piston pumps<br><i>T Nafz, H Murrenhoff, R Rudik</i> | 327 |
| Design and optimisation of a novel hydraulic free piston engine with liquid-propellant-power<br><i>H Ren, H Xie, H Yang</i> | 343 |
| Adaptive attenuation of narrow band fluid-borne noise in a simple hydraulic system<br><i>L Wang, N Johnston</i>             | 357 |

## **Session 8 Control II**

|  |     |
|--|-----|
| The design of fuzzy parameter self-tuning PID temperature controllers for large-scale hydraulic power units<br><i>C Chen, G Gong, H Yang, B Feng</i>                             | 373 |
| Higher-order sliding modes for an electropneumatic system: differentiation and output-feedback control<br><i>L Sidhom, M Smaoui, M Di Loreto, X Brun, E Bideaux, D Thomasset</i> | 385 |
| Comparison of digital hydraulic and traditional servo system in demanding water hydraulic tracking control<br><i>M Linjama, J Seppälä, J Mattila, M Vilenius</i>                 | 397 |

## **Session 9 Systems, modelling and design**

Study on the opening characteristics of super-high voltage circuit breakers with hydraulic operating mechanism 411  
*W Liu, B Xu, H Yang, Z Wu*

Compositional modelling of fluid power systems using predictive tradeoff models 425  
*R Malak, L Tucker, C Paredis*

A novel high efficiency electro-hydrostatic flight simulator motion system 441  
*K Cleasby, A Plummer*

## **Session 10 High performance valves II**

Oil stiction in hydraulic valves - an experimental investigation 457  
*M Resch, R Scheidl*

Influencing parameters on tightness of hydraulic seat valves 471  
*M Schmidt, H Murrenhoff, H Lohrberg, F-J Korber*

Application of proportional seat valves to a self-energising electro-hydraulic brake 483  
*J Ewald, M Liermann, C Stammen, H Murrenhoff*

Experimental evaluation of a metering poppet valve 499  
*R Fales, C Li*

## **Session 11 Control III**

Force control of a roller-screw electro-mechanical actuator for dynamic loading of aerospace actuators 515  
*K Wissam, J-C Mare*

Controlling a conventional LS-pump based on electrically measured LS-pressure 531  
*T Andersen, H Pedersen, M Hansen*

Equalization techniques for dual redundant electrohydraulic servoactuators for flight control systems 547  
*G Jacazio, L Gastaldi*