

**FINAL REPORT of Olena Mul**  
**FCT Postdoctoral fellowship SFRH/BPD/14946/2004**  
**(Relatório detalhado dos trabalhos realizados e plano de trabalho futuro)**

My Postdoctoral fellowship in the University of Aveiro began at July, 1, 2004.

According to the research plan, I investigated possible vibrations in the nonlinear dynamical systems of big size spacecrafts and controlled machine units. Both numerical and asymptotical methods were developed for the investigations, which allowed to determine frequencies and amplitudes of vibrations as well as conditions of stability of the considered construction and possibilities of vibrations active control. The obtained results may be applied for design of the improved technical systems both in space-system engineering and in heavy, extractive and manufacturing industry.

During my fellowship in the University of Aveiro I published the results of my work in two preprints, which are at the moment under reviewing in the International scientific journals, and two papers:

1) Olena V. Mul and Delfim F. M. Torres, **Analysis of Vibrations in Large Flexible Hybrid Systems**, *Research report (Cadernos de Matemática)* CM04/I-30, Dep. Mathematics, Univ. Aveiro, December 2004, <http://www.pisharp.org/dspace/handle/123456789/5> (the paper version of this preprint is enclosed, see Appendix 1).

2) Olena V. Mul, **Analysis and Control of Vibrations in Some Machine Units with Discrete Parameters**, *Série de Investigação (Cadernos de Matemática)* CM05/I-14, Dep. Mathematics, Univ. Aveiro, April 2005, <http://www.pisharp.org/dspace/handle/2052/62> (the paper version of this preprint is enclosed, see Appendix 2).

3) Bodrova, L., Kramar, G., Bodrov, V., Mul, O.: **Investigation of the Mechanism of High Temperature Oxidation of TiC-5VC-18NiCr-2AlN Cermets**, in: *Proceedings PM 2004 "Powder Metallurgy World Congress"*, Vienna, Austria, 2004, vol. 3, pp.605-610 (the photocopy of this paper is enclosed, see Appendix 3).

4) Tydnjuk, V., Kravchenko, V., Mul, O., Shut, M.: **Information Interaction of Thermochemical Potentials in Living Organisms and General Theory of Relativity**, in: *International Scientific Journal of Computing*, vol. 3, issue 2, Ternopil, 2004, pp.91-98 (the photocopy of this paper is enclosed, see Appendix 4).

Also my paper in Ukrainian written together with my scientific coordinator Delfim F. M. Torres **"Чисельний метод дослідження коливань у великих гнучких системах [The numerical method of investigations of vibrations in large flexible systems]"** is already accepted for publication in *International Scientific Journal of Computing*, vol. 4, issue 2, Ternopil, 2005, pp.7-12 (the copy of this paper is enclosed, see Appendix 5).

During the period of the fellowship there were made the next presentations at the international scientific conferences, meetings and seminars:

1) **"On Control of Vibrations in the Complex Dynamical Systems of Machine Units"**, *the Fifth International Conference on Optimization "Optimization 2004"*, Lisbon, Portugal, July 25-28, 2004 (the copy of the presentation is enclosed, see Appendix 6).

2) **"Control of Vibrations in Some Hybrid Systems of Controlled Machine Units"**, *Third Junior European Meeting on Control, Optimization and Computation*, Aveiro, Portugal, September 6-8, 2004 (the copy of the presentation is enclosed, see Appendix 7).

3) "**Differential Equations in Some Applications of Systems Analysis**", *the conference "CR Geometry and Partial Differential Equations"*, Levico Terme, Trento, Italy, September 12-17, 2004, Grant of C.I.R.M. for partial financial support (the copies of the invitation letter, the certificate of the attendance and the presentation are enclosed, see Appendix 8).

4) "**Investigation of the Mechanism of High Temperature Oxidation of TiC-5VC-18NiCr-2AlN Cermets**", *Powder Metallurgy World Congress "PM 2004"*, Vienna, Austria, October 17-21, 2004 (the copy of the presentation is enclosed, see Appendix 9).

5) "**Analysis of Vibrations in Large Flexible Hybrid Systems**", Seminar of CEOC, University of Aveiro, Portugal, February 11, 2005 (the copy of the presentation is enclosed, see Appendix 10).

6) "**Analysis of Vibrations in Some Machine Units with Discrete Parameters**", Seminar of CEOC, University of Aveiro, Portugal, April 15, 2005 (the copy of the presentation is enclosed, see Appendix 11).

The next abstracts of these presentations were published:

1) Mul, O.: **On Control of Vibrations in the Complex Dynamical Systems of Machine Units**, in: *Abstracts of the Fifth International Conference on Optimization "Optimization 2004"*, Lisbon, 2004, p.35 (the photocopy of this abstract is enclosed, see Appendix 12).

2) Mul, O.: **Control of vibrations in some hybrid systems of controlled machine units**, in: *Preprints of the Third Junior European Meeting on Control, Optimization and Computation*, Cadernos de Matemática CM05/I-04, Dep. Mathematics, Univ. Aveiro, February 2005, p.191 (the photocopy of this abstract is enclosed, see Appendix 13).

Also the abstract "**On Asymptotical Method for Vibrations Analysis of Large Elastic Dynamical Systems**" is accepted for participation in *the Sixth International Conference "Symmetry In Nonlinear Mathematical Physics"*, Kiev, Ukraine, June 20-26, 2005, <http://www.imath.kiev.ua/~appmath/conf.html> (the copy of the invitation letter and the abstract are enclosed, see Appendix 14).

Besides I was a member of the Organizing Committee of Third Junior European Meeting on Control, Optimization and Computation, Aveiro, Portugal, September 6-8, 2004.

I also participated in the Scientific Meeting "**Optimização e Controlo Ótimo, CEOC(Aveiro) – CIMA-UE(Évora) 2005**", Department of Mathematics, University of Evora, April 22-23, 2005.

I am very grateful both to FCT and to the University of Aveiro and the Control Theory Group of the Center for Research in Optimization and Control for the hospitality and the perfect working conditions.

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27/04/2005

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