

## 0.1. WORK PLAN, DELIVERABLES AND LOAD BALANCING

**Work plan.** Planning in time, the order of execution of the objectives and specific tasks are presented and discussed below. The effective evaluation of the work progress is considered at the end of four work packages (WP). At the beginning of each WP the objectives are defined and explained.

In the following, each WP is described and shortly discussed from duration, components and results aspects. Each WP has a specific dissemination plan, including, among others, the results publishing in ISI journals and proceedings of conferences organized by IFAC and IEEE.

### WORK PACKAGE LIST

Work package No	Work package title	Work package leader	Person / month	Start month	End month
1	Analysis of CDD systems in vibrational processes	P1	37.55	1	7
2	Design of the experimental model structure and of CDD methods to be implemented	P2	60,98	8	14
3	Software modules for CDD and experimental model development	P3	58,04	15	20
4	Experiments for experimental model evaluation	CO	75.33	21	26
<b>TOTAL</b>			<b>212,75</b>		

Using the table below, indicate the description for each work package, specifying the technical and scientific milestones, the bottlenecks or contingencies that could jeopardize the project outcome, and the planned project meetings.

### WORK PACKAGE DESCRIPTION

<b>WP no.</b>	<b>1</b>				
<b>WP title</b>	Analysis of CDD systems in vibrational processes				
<b>WP leader</b>	P1				
<b>Involved partners</b>	<b>CO</b>	<b>P1</b>	<b>P2</b>	<b>P3</b>	<b>Total</b>
<b>Person-months</b>	7,9	9,74	3.58	13,33	37,55
<b>Start month</b>	<b>1</b>				
<b>End month</b>	<b>7</b>				
<b>Objectives</b>					
<p><b>O1:</b> Obtaining of a definitive reference, to date, in the field of CDD techniques for vibrational processes monitoring, by analysis of different categories of signals (vibration, acoustic, and ultra-acoustic)</p> <p><b>O2:</b> Results dissemination.</p>					
<b>Description of work and role of participants</b>					
<p>The WP is referring to study, analysis and evaluation of various existing methods, techniques and algorithms, making a complete and actual reference, as possible, in the CDD problem. The set of principles, the available numerical algorithms and major applications will be considered and discussed. The international experience and results will be considered as</p>					

well, by making also visits at some research laboratories from Europe. The research directions, results and open problems will be considered as well. The base tasks and the contributions of partners are:

**T1:** Analysis of the monitoring systems and of generated signals in vibrational processes (CO,P1,P2)

**T2:** Analysis of adopted solutions in vibrational process monitoring for machines and equipments from industrial plants (CO, P1, P2)

**T3:** Theoretical and algorithmical formalization of CDD problem (CO,P1)

**T4:** Structure, functions and performance analysis of some commercial systems, for CDD, including hardware and software aspects (P3)

**T5:** Visits at some research laboratories for experience change and discussions on CDD problems (CO,P1, P2)

**T6:** Results dissemination (CO,P1,P2)

**T7:** Project management (CO)

**Deliverables (brief description and month of delivery)**

**D1:** Research report: Study on CDD techniques, methods and algorithms with application in vibrational process monitoring (month 7)

**D2:** Research report: Study on commercial systems for CDD (month 7)

**D3:** Scientific papers: 1 in journal ISI and 3 in int. conferences (month 7)

<b>WP no.</b>	<b>2</b>				
<b>WP title</b>	Design of the experimental model structure and of CDD methods to be implemented				
<b>WP leader</b>	P2				
<b>Involved partners</b>	<b>CO</b>	<b>P1</b>	<b>P2</b>	<b>P3</b>	<b>Total</b>
<b>Person-months</b>	13,11	19,35	11,35	17,17	<b>60,98</b>
<b>Start month</b>	<b>8</b>				
<b>End month</b>	<b>14</b>				
<b>Objectives</b>					
<b>O1:</b> Deepening of the theories and practices in CDD field. Optimization of the existing algorithms.					
<b>O2:</b> Development of new methods, algorithms and techniques in CDD					
<b>O3:</b> Design of the basic structure of the experimental model and of the support systems for measuring and testing.					
<b>O4 :</b> Results dissemination					
<b>Description of work and role of participants</b>					
<p>The WP refers to necessary techniques assessment, functional request identification, and architecture defining of the experimental model and of CDD methods to be implemented. The known algorithms will be optimized and new methods and techniques for CDD will be developed, as new outcomes of the projects: information fusion coming from three signal categories, new advanced signal processing techniques from soft computing field (neural nets, fuzzy techniques and genetic algorithms), etc.</p> <p>WP 2 comes after 7 months from the beginning of the project. During the next 7 months, the experience gained in the WP 1 will be extended and the technical requests will be clarified and finalized, as well as the functional requests, the model architecture, and the design of the components in the support systems for measuring and testing. Some numerical results concerning the efficiency of some software components for CDD will be available. The basic tasks and the partner's contributions are:</p> <p><b>T1:</b> Establishing of the vibrational processes to be investigated and monitored (CO,P1,P2, P3)</p> <p><b>T2:</b> Existing algorithms optimization (CO, P1)</p>					

<b>T3:</b> Development of new methods, algorithms and techniques, answering to identified open problems in CDD (CO,P1)
<b>T4:</b> Establishing of the functional requests and defining of the experimental model architecture (CO,P1,P2)
<b>T5:</b> Architecture design of the experimental model and of the support systems (CO,P1,P2, P3)
<b>T6:</b> Establishing of sensor choice and mounting criteria (P2, P3)
<b>T7:</b> Selection and acquisition of necessary components (CO, P3)
<b>T8:</b> Results dissemination (CO,P1,P2, P3)
<b>T9:</b> Project management (CO)
<b>Deliverables (brief description and month of delivery)</b>
<b>D1:</b> Research report: New CDD methods (month 14)
<b>D2:</b> Research report : Project experimental model (month 14)
<b>D3:</b> Research report : Project support systems for measuring and testing (month 14)
<b>D4:</b> Scientific papers: 1 in journal ISI and 4 in int. conferences (starting with month 14)

<b>WP no.</b>	<b>3</b>				
<b>WP title</b>	Software modules for CDD and experimental model development				
<b>WP leader</b>	<b>P3</b>				
<b>Involved partners</b>	<b>CO</b>	<b>P1</b>	<b>P2</b>	<b>P3</b>	<b>Total</b>
<b>Person-months</b>	12,84	14,61	3,72	26,88	<b>58,04</b>
<b>Start month</b>	<b>15</b>				
<b>End month</b>	<b>20</b>				
<b>Objectives</b>					
<b>O1:</b> Software library for CDD development					
<b>O2:</b> CDD software components validation and functional optimization					
<b>O3:</b> Testing and performance evaluation, in simulation, of CDD software components, concerning their robustness to operational environment (signal/noise ratio), as well as to failure of some design hypotheses					
<b>O4:</b> Development of the experimental model and of the support systems for measuring and testing					
<b>O5:</b> Results dissemination					
<b>Description of work and role of participants</b>					
<p>In this WP, a software library for CDD will be developed, as a toolbox Matlab, where each algorithm will be implemented as a function, having a demo program associated. Performance evaluation and comparison of the implemented methods, techniques and algorithms will be made, firstly, by Monte Carlo simulation, having as objective, to proof their robustness to working conditions (signal/noise ratio) and also to some hypotheses difficult to be carried out in practice. The sensitivity and versatility aspects of CDD algorithms will be considered as well. Also, in this WP the experimental model for CDD and the support systems for measuring and testing will be developed. The methods and algorithms to be implemented are from the previous WP, mainly.</p> <p>WP 3 is running after 15 months from the beginning of the project. Now, the experimental model for CDD is available and the functional testing with real data could begin. The basic tasks and the contributions of the partners are:</p>					
<b>T1:</b> CDD software library development (CO,P1)					
<b>T2:</b> CDD software components validation and functional optimization (CO,P1,P2)					
<b>T3:</b> Evaluation and comparison of implemented methods, techniques and algorithms by Monte Carlo simulation (CO,P1,P2)					
<b>T4:</b> Development and functional testing of the experimental model and of the support systems for measuring and testing (CO, P3)					

<b>T5:</b> Results dissemination (CO,P1,P2, P3) <b>T6:</b> Project management (CO)
<b>Deliverables (brief description and month of delivery)</b>
<b>D1:</b> Research report :CDD software library (month 20) <b>D2:</b> Research report: Testing, validation and optimization of CDD software library (month 20) <b>D3:</b> Experimental model for CDD (month 20) <b>D4:</b> Experimental report: Functional testing of the experimental model and of support systems (month 20) <b>D4:</b> Scientific papers: 2 in journals ISI and 4 in int. conferences (beginning with month 20)

<b>WP no.</b>	<b>4</b>				
<b>WP title</b>	Experiments for experimental model evaluation				
<b>WP leader</b>	<b>CO</b>				
<b>Involved partners</b>	<b>CO</b>	<b>P1</b>	<b>P2</b>	<b>P3</b>	<b>Total</b>
<b>Person-months</b>	15,25	18,76	10,61	30,92	<b>75,53</b>
<b>Start month</b>	<b>21</b>				
<b>End month</b>	<b>26</b>				
<b>Objectives</b>					
<b>O1 :</b> Experimental model testing in laboratory and in industrial environment <b>O2:</b> Result dissemination					
<b>Description of work and role of participants</b>					
<p>The experimental model will be tested for performance evaluation, in laboratory on pilot machine tools, using different scenarios to induce machine failures, as well as on the components of an industrial process, thin strip mill, in real operating conditions, at S.C. ArcelorMittal S.A. Galati. The WP will have as goal to demonstrate the functionality of the experimental model in monitoring of some vibrational processes, as main application of the project. So, the capabilities of the experimental model to detect incipient changes and faults in some components of a real industrial process operating in a complex environment will be proved; the results comparison with those available for other CDD industrial platforms, will be possible. The main tasks of partners are:</p> <p><b>T1:</b> Experimental model testing on laboratory pilot machines and plants (CO, P1, P2, P3) <b>T2:</b> Experimental model testing on a real industrial process - thin strip mill (CO, P1, P2, P3) <b>T3:</b> Elaboration of User Manual for CDD software library (CO,P1,P2) <b>T4:</b> Elaboration of User Manual for experimental model (CO,P2,P3) <b>T5:</b> Results dissemination (CO,P1,P2, P3) <b>T6:</b> Project management (CO)</p>					
<b>Deliverables (brief description and month of delivery)</b>					
<b>D1:</b> Experimental report: CDD by machine monitoring in the lab (month 23) <b>D2:</b> Experimental report: CDD by process monitoring in industrial environment (month 24) <b>D3:</b> User Manual for CDD software library (month 24) <b>D4:</b> User Manual for experimental model (month 24) <b>D5:</b> Scientific papers: 3 in journals ISI and 5 in int. conferences (beginning with month 20) <b>D6:</b> 1-2 Patents (new CDD methods + experimental model) (starting with month 26)					