## Project Interim Progress Report (Rapport d’avancement de project intérimaire) July 1, 2016 - January 31, 2017 Please submit by January 16, 2017 (Attn: Joanne O’Connor [management@nserc-canrimt.org](mailto:management@nserc-canrimt.org))

## Instructions

*This progress report, updated milestones**and the Form 300 are required as a condition of research funding support from the sponsors of the NSERC CANRIMT.* ***Please report for activity in the current reporting period only.***

**SUMMARY**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **THEME :** *Model assisted machining monitoring and control* | | | | | | René Mayer, Polytechnique Montréal | | |
| **PROJECT II.B.3:** *Machine Precision Monitoring* | | | | | | Sofiane Achiche, Polytechnique Montréal | | |
| **PROJECT DURATION/DURÉE DU PROJET : 3 years** | | | | | | | | |
| **STATUS/STATUT:** *(****Milestones*** *to be updated by each Project Leader)* | | | | | | | | |
| **Ahead of Schedule** |  | **On Schedule** | **x** | **Delayed** |  | | **Cancelled** |  |

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| **PROJECT DESCRIPTION/ DESCRIPTION DU PROJECT**  (*Brief description in point form, including role of project in Theme.)* |
| * It is known that a machine tool which is working below expected precision will produce costly scrap. * This project will study a machine tool’s evolution throughout its working life with a view to detect, diagnose and anticipate significant and abnormal changes in geometric behaviour that warrant corrective actions. * The developed machine condition monitoring solution must guide the maintenance team for the most appropriate corrective actions. |

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| **PROJECT OBJECTIVES & METHODOLOGY/ OBJECTIFS DU PROJET & MÉTHODOLOGIE**  *(Include alignment with Network objectives.)* |
| The objectives of this project align with the goal of developing, in the long term, an integrated solution for Virtual Model Assisted Machining Monitoring. This will be achieved by the following three objectives:   1. Monitoring the machine status using geometric data combined to machine learning techniques. 2. Monitoring the machine status using physical parameters modelled using artificial intelligence techniques. 3. Define a global and normalised monitoring signal combining the findings of objective 1 and 2.   In order to attain these objectives the following steps will be followed:   1. Define the state of the art in machine tool monitoring 2. Define the variables to be used for monitoring purposes 3. Defining the experimental set-up for data collection for the gemtric and physical information data 4. Data treatment and analysis 5. Matching data patterns with machine status info 6. Prediction modeling for monitoring |
| **1. RESEARCH TEAM/ ÉQUIPE DE RECHERCHE** *(Summary for the current reporting period)* |

**1a: Research Personnel (Supervisors, Co-Supervisors, Collaborators)/   
Personnel de recherche**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Name, given name/ Nom., prénom* | *Organization/ Organisation* | *Sup./Co-Sup./*  *Collaborator* | *E-mail/Courriel* | *Phone No./ Téléphone* |
| Mayer, René | Polytechnique  Montréal | Co-supervisor | René.mayer@polymtl.ca | 514-3404711  #4407 |
| Achiche, Sofiane | Polytechnique  Montréal | Supervisor | [Sofiane.achiche@polymtl.ca](mailto:Sofiane.achiche@polymtl.ca) | 514-3404711  #4317 |

**1b: Students, Postdoctoral Fellows, Research Assist./  
Assoc./Eng., Technical/Professional, Guests** *(from outside Province; from outside Canada)***/  
Étudiants, Boursier de recherches postdoctorales, assistants, techniciens et invites** *(invite hors Province; hors Canada)*

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Name, given name/ Nom., prénom* | *Position* | *Organization/ Organisation* | *Name/Nom. (S) or /ou (C)\** | *Start/ Début* | *End/ Fin* | *CANRIMT Salary/Mo incl ben.* | *Extern. funding amount* | *Extern funding source* |
| Gabriel Bernard | PhD | Polytechnique  Montréal | S. Achiche(S)  Mayer© | **09/01/2017** | **31/12/2021** | ***1750*** | ***0*** |  |
| Kanglin Xing | PhD | Polytechnique  Montréal | Achiche(S)  Mayer (C) | **01/01/2016** | **30/04/2020** | **1750** | **1750** | **Chinese Scholarship from Sept. 2016** |
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***\*(S) – Supervisor  
 (C) – Co-Supervisor***

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| **TOTAL #** | **BASc** | **MASc/**  **M.Eng.** | **Ph.D.** | **PDF** | **Res. Asst.** | **Res. Assoc.** | **Res. Eng.** | **Tech./ Prof.** | **Guests/ outside Province** | **Guests/ outside Canada** |
|  |  |  | **2** |  |  |  |  |  |  |  |

**1c: Partners & Contributions/   
Partenaires et Contributions**

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| --- | --- | --- | --- | --- | --- | --- |
| *Organization / Organisation* | *Acronym/ Acronyme* | *Contact* | *Cash/ Espèce* | *In-Kind/ Nature* | *Overhead/ Frais généraux* | *Total* |
| **P&WC** |  | **Serafettin Engin** | **Unknown** |  |  |  |
| **ALCOA** |  | **Rene Barakett** | **Unknown** |  |  |  |
| **2. RESEARCH PLAN FOR THE CURRENT PERIOD/PLAN DE RECHERCHE POUR  LA PÉRIOD ACTUELLE** *(Please list both the technical objectives, methodologies and milestones as stated in the previous report.)* | | | | | | |
| **No previous report was done. This is my first.** | | | | | | |

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| **3. ALIGNMENT OF RESEARCH PROJECT WITH NETWORK OBJECTIVES/ ALIGNEMENT DU PROJET DE RECHERCHE AVEC LES OBJECTIFS DU RÉSEAU** *( Please comment on the alignment of the research project with the overall Network objectives.)* |
| **The research project aligns well within the Networks Objectives. This project brings in a key digital support of monitoring wither a machine tool in situ or even remotely.**  **The condition monitoring system will also support the development of a fully computer controlled machine tools and support the self-adjustment of operating condition through a better understanding of its potential failures.** |

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| **4. PROBLEMS and RESOLUTIONS/ PROBLEMES ET SOLUTIONS PROPOSÉES** *( Please summarize any problems arising during the current reporting period and their resolution or plans for resolution.)* |
| *Problem/ Problème:*  *We still did not receive any funding*  *Resolution / Résolution:*  *I am paying the students on another fund waiting for the funding.* |

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| **5. RESEARCH PROGRESS and RESULTS/ PROGRÈS DE LA RECHERCHE et RESULTATS:** *(Summarize progress and results below.)* |

**5a: MILESTONES/ÉTAPES**  
*Summarize progress on milestones – including % completed – as outlined in the Research Plan for the current reporting period and any modifications since the last reporting period.* *(Milestones document also to be updated for each project.)*

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| **MILESTONE/ ÉTAPE:** | |
| **Progress: Literature Review on Machine Tools Monitoring Techniques**  **Modifications: none** | |
| **% Completed/ Rempli** | **75%** |
| **Progress: Review of needed material for experimental Set-Up**  **Modifications: none** | |
| **% Completed/ Rempli** | **50%** |
| **Progress: Modeling the influence of volumetric error on machine precision**  **Modifications: none** | |
| **% Completed/ Rempli** | **50%** |
| **Progress: Data collection for geometric information on operating machine tool**  **Modifications: Information related to machine tools dynamics will be also captured** | |
| **% Completed/ Rempli** | **50%** |
| **Progress: Data Treatment for Building Signature Files Building**  **Modifications: none** | |
| **% Completed/ Rempli** | **15%** |
| **Progress: Model prediction construction using AI**  **Modifications: none** | |
| **% Completed/ Rempli** | **15%%** |
| **Progress: Model Testing Using User Scenarios of the Machine Tool**  **Modifications: none** | |
| **% Completed/ Rempli** | **0%** |
| **Progress: Knowledge dissemination**  **Modifications: none** | |
| **% Completed/ Rempli** | **20%** |

**Model Testing Using User Scenarios of the Machine Tool**

**5b: PUBLICATIONS and PRESENTATIONS / PUBLICATIONS ET PRESENTATIONS**

*Please list all publications directly arising from Network-funded research during the current period. Do not include abstracts.*

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| ***A: REFEREED CONTRIBUTIONS - ARTICLES***  *Include articles in refereed publications – please specify whether the article has been submitted (S), accepted (A) or published (P).* | | | |
| Last Name, Initial | *Year* | *Title, Journal, Volume* | *Status* |
| Kanglin XING, Sofiane Achiche, René Mayer | *2016* | *Machine Tools Volumetric Accuracy Change Analysis Using Vector Similarity Methods, Journal of manufacturing science and engineering, November 2016* | *Under revision* |
| ***B: REFEREED CONTRIBUTIONS - OTHER***  *Include papers in refereed conference proceedings, letters, notes, communications, review articles, monographs, books, book chapters and government publications.* | | | |
| Last Name, Initial | *Year* | *Description* | *Status* |
| Kanglin XING, Sofiane Achiche, René Mayer | 2016 | *VMPT 2016 - 5th International Conference on Virtual Machining Process Technology, Taipei, Taiwan, 22-25 may 2016* | published |
|  |  | Journal/Book/Publication Title (Status: S-submitted; A-accepted; P-published) |  |
| ***C: NON-REFEREED CONTRIBUTIONS***  *Include papers in non-refereed conference proceedings, papers, letters and review articles.* | | | |
| Last Name, Initial | *Year* | *Description* | |
|  |  | Conference Title, Location and Date | |
|  |  | Journal/Book/Publication Title | |
| ***D: SPECIALIZED PUBLICATIONS - PRESENTATIONS***  *Include theses, presentations, industrial/technical reports, internal reports, discussions of abstracts and symposium records.* | | | |
| Last Name, Initial | *Year* | *Description* | |
|  |  | Thesis or Conference Title, Location and Date | |
|  |  | Journal/Book/Publication Title | |
| ***E: PUBLICATIONS –  Not originally funded by NSERC CANRIMT but continuing or completed with Network funding*** | | | |
| Last Name, Initial | *Year* | *Description/Title* ***(include start date of NSERC CANRIMT funding)*** | |
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| ***F: PUBLICATIONS – Not funded by NSERC CANRIMT but related to the Network research focus*** | | | |
| Last Name, Initial | *Year* | *Description/Title* | |
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**5c: PATENTS and LICENSES/ BREVETS ET LICENSES**

*Non-disclosure agreements signed, patent applications filed, patents issued, copyrights, licenses under negotiation, licenses granted, etc.*

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| *Category* | *Owner* | *Description* |
|  |  |  |

**5d: OTHER COMMUNICATIONS, AWARDS/ AUTRES COMMUNICATIONS, PRIX**

*Provide information on additional communications related to your work, such as awards and distinctions, news stories, interviews, public forums, press releases, etc. for the current reporting period (please provide copies or links.)*

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| --- | --- | --- | --- |
| *Name, given name/ Nom, prénom* | *Details* | *Date* | *Link or copy attached* |
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| **6. TRAINING/ FORMATION** *(Describe the extent of cross-network and partner involvement in training for the current reporting period.)* |
| Not yet. The students just joined. |

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| **7. RESEARCH PLAN FOR NEXT 6 MONTHS/ PLAN DE RECHERCHE POUR LES 6 PROCHAINS MOIS***(Describe Planned Research Activities for the next 6 month period and include any modifications made during the current reporting period.); also please list both the technical objectives and milestones.)* |
| 1. **Finalize data collection for volumetric error measurements** 2. **Developing a comprehensive model for volumetric error modeling and influence on machine condition** 3. **Plan data collection for physical parameters modelling, including the use of IMUs.** 4. **Selection of the most adequate artificial intelligence modelling tool for condition monitoring** |

**8. OPTIONAL – Comments, Questions and/or Feedback/  
OPTION – Commentaires, questions et/ou des commentaires**

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| *Include any supplemental comments or questions pertaining to the Network here.* |
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**9. NETWORK EVENTS ATTENDED or SUGGESTIONS /  
ÉVÉNEMENTS RÉSEAU ONT ASSISTÉ ou SUGGESTIONS**

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| *Please list any Network-related events attended and include comments and suggestions for events which may be helpful and informative for Network members to attend in future.* | |
| *Event* | *Comments/Suggestions* |
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