

**NSERC Canadian Network
for Research and Innovation in
Machining Technology (CANRIMT2)
NSERC Project Number: NETGP 479639 - 15**



**Project Interim Progress Report
(Rapport d'avancement de project intérimaire)
May 1- Oct 31, 2019**

**Please submit by Oct 25, 2019
(Attn: Lu Pan management@nserc-canrmt.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

THEME I: Digital Machining	Leader/ Chef: <i>Dr. Kaan Erkorkmaz, UWaterloo</i>
PROJECT I.A.8: Modeling of threading thin-walled oil pipes with varying dynamics	Leader/ Chef: <i>Dr. Matt Khoshdarregi, UManitoba</i>
PROJECT DURATION/DURÉE DU PROJET: Jan 2019-	
STATUS/STATUT: <i>(Milestones to be updated by each Project Leader)</i>	
Ahead of Schedule <input type="checkbox"/>	On Schedule <input checked="" type="checkbox"/>
Delayed <input type="checkbox"/>	Cancelled <input type="checkbox"/>

PROJECT DESCRIPTION/ DESCRIPTION DU PROJET <i>(Brief description in point form, including role of project in Theme.)</i>
This project aims at developing reliable chatter stability models for thread turning of thin-walled oil pipes with varying structural dynamics. The project contributes to THEME I by developing digital models for thread turning operations widely used in the oil and gas industry.

PROJECT OBJECTIVES & METHODOLOGY/ OBJECTIFS DU PROJET & MÉTHODOLOGIE <i>(Include alignment with Network objectives.)</i>
Pipes used in the extraction and transportation of offshore oil are attached to each other using threaded joints. The threads are generated by thread turning operations on large industrial lathes. Due to the shell-mode flexibilities of oil pipes, which behave as thin-walled cylindrical shells, excessive chatter vibrations occur during the threading process. Chatter vibrations leave deep surface marks which may later cause fatigue failure of the joints in pipelines. In order to predict and avoid unstable chatter vibrations, this project develops mathematical models describing the dynamics of thread turning of oil pipes. The proposed research builds upon the threading models developed previously by Dr. Khoshdarregi (CANRIMT I.A.3, UBC-TAMSA). In this project, the accuracy of the chatter prediction model will be improved by including the effect of the varying structural dynamics of pipes due to material removal. The outcome of this project will help maximize the productivity and quality of threading of oil pipes.
Methodology:
- Develop efficient FRF-updating methods to model the varying structural dynamics of oil pipes as a result of material removal without remeshing/solving the complete finite element problem at each step.
- Verify the FRF-updating model for simple turning operations

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- Validate the FRF-updating model for sample threaded tubes
- Employ the FRF-updating technique along with the threading chip model (developed by Dr. Khoshdarregi) to predict the structural dynamics of the pipe during/after each threading pass with custom multi-point threading inserts.
- Develop a chatter stability model for thread turning operations considering the varying structural dynamics of the part.
- Experimental validation of the chatter stability model on thin-walled tubes.

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
Khoshdarregi, Matt	UManitoba	Supervisor	m.khoshdarregi@umanitoba.ca	204-474-6153

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 invités
(invite hors Province; hors Canada)

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
Maghami, Seyedali	PhD Student	UManitoba	Khoshdarregi (S)	Jan 2019	Dec 2022	\$420/MO	\$1500/MO	UManitoba

*(S) – Supervisor
(C) – Co-Supervisor

TOTAL #	BASc	MASc/ M.Eng.	Ph.D.	PDF	Res. Asst.	Res. Assoc.	Res. Eng.	Tech./ Prof.	Guests/ outside Province	Guests/ outside Canada
1			1							

1c: Partners & Contributions/
Partenaires et Contributions

Organization / Organisation	Acronym/ Acronyme	Contact	Cash/ Espèce	In-Kind/ Nature	Overhead/ Frais généraux	Total
Tenaris TAMSA	TAMSA	Ramon Aguilar				

2. RESEARCH PLAN FOR THE CURRENT PERIOD/PLAN DE RECHERCHE POUR LA PÉRIODE ACTUELLE (Please list both the technical objectives, methodologies and milestones as stated in the previous report.)

Objective: Develop and verify an FRF-updating technique to quickly obtain the structural dynamics of the workpiece as material is being removed during the threading operation.

Methodology: Start with an initial meshed model of the pipe. Assemble the mass and stiffness matrices. As the material is removed, add "negative" mass corresponding to the removed material, and update the mass and stiffness matrices without remeshing the part.

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 proposed research develops accurate digital machining models for threading operations widely used in the oil and gas industry. The developed stability models will broaden our understanding of the dynamics of machining workpieces with varying dynamics. Such models can be used to maximize productivity in machining operations such as threading oil pipes.

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.)

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

5a: MILESTONES/ÉTAPES

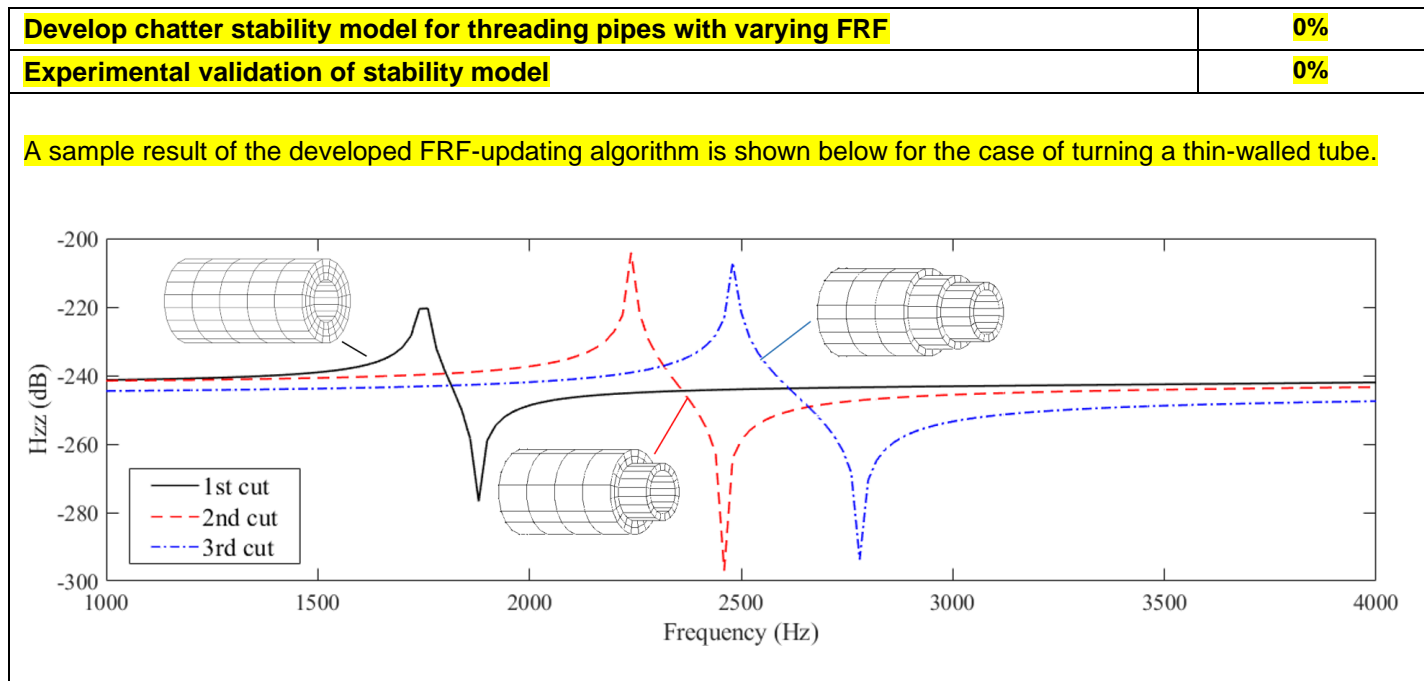
Summarize progress on milestones – including % completed – as outlined in the Research Plan for the current reporting period and any modifications since the last reporting period. (Milestones document also to be updated for each project.)

MILESTONE/ ÉTAPE: Develop an efficient FRF-updating technique

Progress: The initial FRF-updating code has been developed in MATLAB. The predicted FRFs for simple geometries have been verified against the results given by ANSYS. Further verification and generalization of the code is being carried out. The student working on this project started in January 2019 and is still taking his courses. Therefore, he has not been able to start working full-time on this project yet.

Modifications:-

Literature Review	100%
Develop an efficient FRF-updating algorithm	30%
Verify FRF-updating method in simple turning of thin-walled tubes	30%
Verify FRF-updating method for sample threaded tubes	0%



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.

A: REFEREED CONTRIBUTIONS - ARTICLES			
<i>Include articles in refereed publications – please specify whether the article has been submitted (S), accepted (A) or published (P).</i>			
Last Name, Initial	Year	Title, Journal, Volume	Status
B: REFEREED CONTRIBUTIONS - OTHER			
<i>Include papers in refereed conference proceedings, letters, notes, communications, review articles, monographs, books, book chapters and government publications.</i>			
Last Name, Initial	Year	Description	Status
		Conference Title, Location and Date (Status: Invited, Not invited)	
		Journal/Book/Publication Title (Status: S-submitted; A-accepted; P-published)	
C: NON-REFEREED CONTRIBUTIONS			
<i>Include papers in non-refereed conference proceedings, papers, letters and review articles.</i>			
Last Name, Initial	Year	Description	
		Conference Title, Location and Date	
		Journal/Book/Publication Title	
D: SPECIALIZED PUBLICATIONS - PRESENTATIONS			
<i>Include theses, presentations, industrial/technical reports, internal reports, discussions of abstracts and symposium records.</i>			
Last Name, Initial	Year	Description	
		Thesis or Conference Title, Location and Date	

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		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)
F: PUBLICATIONS – Not funded by NSERC CANRIMT but related to the Network research focus		
Last Name, Initial	Year	Description/Title

5c: PATENTS and LICENSES/ BREVETS ET LICENSES

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

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.)

Name, given name/ Nom, prénom	Details	Date	Link or copy attached

6. TRAINING/ FORMATION

(Describe the extent of cross-network and partner involvement in training for the current reporting period.)

Since the project is at an early stage, the PhD student (Seyedali Maghami) is currently working on developing the models. Once the FRF-updating and chatter prediction models are completed, a visit/internship at the site of the industrial partner (Tenaris TAMSA) may be arranged for validation of the models on real-scale oil pipes.

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.)*

The main plan for the next 6 months is to complete and validate the FRF-updating algorithms. The model will be extended to thin-walled tubes and verified against the full solutions obtained from commercial software packages. The FRF-updating module will be used in the next step to predict chatter stability in threading thin-walled oil pipes.

PROJECT I.A.8: Modeling of threading thin-walled oil pipes with varying dynamics

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

Include any supplemental comments or questions pertaining to the Network here.

The student working on this project started in January 2019 and is still taking courses. Therefore, he has not started working full-time on this research.

9. **NETWORK EVENTS ATTENDED or SUGGESTIONS /**
ÉVÉNEMENTS RÉSEAU ONT ASSISTÉ ou SUGGESTIONS

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.

<i>Event</i>	<i>Comments/Suggestions</i>
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