Fellow	SUBBARAO VENKATESH GUGGILAM
Host Organisation	NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET
Scientific coordinator	PROF. KURUSCH EBRAHIMI-FARD

I – SCIENTIFIC ACTIVITY DURING YOUR FELLOWSHIP

1. Worked extensively on the multiplicative feedback interconnection of multi-input multi-output nonlinear systems dynamical systems modelled by Chen-Fliess series. The underlying Hopf algebras arise in the computation of transformation group product associated with multiplicative feedback. The paper also entails some insights into Com-pre-Lie structures.
2. Worked on describing the post-group (integration problem) for the single-input single-output affine feedback problem for which the post-Lie algebra is well-known. The post-group is defined from ab initio view of the affine feedback interconnection.
3. Initiated a draft on the project of defining post-pre-Lie algebra and the Guin-Oudum type construction of its universal enveloping algebra. The draft is in preparation.
4. Worked on describing the composition of Chen-Fliess as homomorphisms of Zinbiel algebras (rather than shuffle algebras).

II – PUBLICATION(S) DURING YOUR FELLOWSHIP

1. *Ebrahimi-Fard K., Venkatesh G. S. , "A Fromal Power Series Approach to Multiplicative Dynamic Feedback Interconnection", arXiv:2301.0949[math.OC] (submitted to Communications in Algebra)*
2. *Ebrahimi-Fard K., Gray W. S. , Venkatesh G. S. " On the Post-Lie structure in SISO Affine Feedback Control Systems", arXiv : 2311.04070[math.OC] (to be submitted to Interntional Mathematics Research Notices)*
3. *Venkatesh G.S., "Composition of Chen-Fliess series and Zinbiel algebras" (submitted to 58th Annual Conference on Information Sciences and Systems)*

III – ATTENDED SEMINARS, WORKHOPS, CONFERENCES

1. *Attended the conference "Category theory at Work in Computational Mathematics and Theoretical informatics" , Bergen , Norway, June 2023.*
2. *Delivered a talk on Post Lie Structures in Affine feedback in Winter Mathematics meeting in Tromso, Norway, January 2023*
3. *Delivered a talk on "Formal Power Series Approach to Multiplicative Feedback" in the conference " Hopf Algebras and Applications", Calais, France , November 2022.*
4. *Delivered a talk on " Combing Learning and Model-based Control" in the conference "Rough Paths, Algebraic Structures and Machine Learning" , Kristiansand, Norway, October 2022.*
5. *.Attended the National Mathematics Meeting (NMM) in Tromso, Norway, September 2022.*

IV – RESEARCH EXCHANGE PROGRAMME (REP)

Research Exchange Program Location: Simula Research Laboratory, Oslo, Norway
Date: August 28 to September 1, 2023.

1. *Actively engaged with researchers in the Department of Computational Physiology and the Department of Numerical analysis and Scientific Computing (SCAN).*
2. *Participated in the weekly meetings of both the departments and held scientific discussions with their researchers.*
3. *Presented a talk "Chen-Fliess Series and its Interconnections: An Overview of the Results" to the Computational Physiology Department*
4. *Participated in all day workshop on "Extreme Modelling on Excitable Tissue (EMIx)" where I could learn the up-to-date research going on in the area of modelling of excitable tissue.*