## ERCIM fellowship Programme

**Final scientific report**

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<tr>
<th>Fellow</th>
<th>SUBBARAO VENKATESH GUGGILAM</th>
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<td>Host Organisation</td>
<td>NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET</td>
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<td>Scientific coordinator</td>
<td>PROF. KURUSCH EBRAHIMI-FARD</td>
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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

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

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.