

**Thesis subject: CLINICAL DECISION SUPPORT SYSTEM FOR FACIAL MIMICS
REHABILITATION**

PhD Supervisor:

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Collaborators: Dr. S. Dakpé (CHU Amiens, clinical evaluation)

Context of the thesis:

This PhD proposal relates to the topic 3.1 « Multi-level and multi-physical optimization of a set of complex systems » of the axis 3 « Optimized design of technological SoSs » of Labex MS2T.

The thesis is also part of the project activities of the Equipment of Excellence (EQUIBEX) FIGURES at the Université de Technologie de Compiègne (UTC) in France.

Cofunding or/and partnerships: Regional Council of Hauts de France

PhD thesis description:

Facial disorders due to stroke, accidental/sportive injuries or sometimes without etiology, affect the professional and personal lives of involved patients [1]. The recovery of facial mimics and a normal and symmetrical facial expression allows these patients to improve their living conditions and social identity.

Functional rehabilitation of facial disorders is an important clinical step to improve the quality of surgical interventions and drug therapies. However, the recovery and rehabilitation of facial mimics and expressiveness remains a major scientific, technological and clinical challenge. Currently, there is no objective clinical assessment tool to supervise and guide functional rehabilitation movements for facial disorders. Numerical modeling and simulation using finite element models have been developed [2, 3]. However, the translation of these models into clinical setting faces to new challenges like model usage, user acceptability and computing time. To overcome these obstacles, this PhD thesis aims to develop a clinical decision support tool for the translation of numerical models into clinical routine practices for facial disorders. System of systems (SoS) approach will be applied to develop this system to manage the interaction complexity between living body system and related technological systems. Moreover, a new efficient meta-model (e.g. surrogate model) will be investigated to animate the facial mimic movements and to visualize their effects in real time conditions.

References:

- [1] TT Dao, S Dakpé, P Pouletaut, B Devauchelle, MC Ho Ba Tho (2013). Facial Mimics Simulation using MRI and Finite Element Analysis. Conf proceedings of IEEE EMBS, pp. 4585-4588.
- [2] MC Ho Ba Tho, TT Dao, S F Bensamoun, S Dakpe, B Devauchelle, M Rachik (2014). Subject Specific Modeling of the Muscle Activation. Application to the Facial Mimics. Advances in Intelligent and Soft Computing (Springer) 245: 423-433.

[3] AX Fan, S Dakpé, TT Dao, P Pouletaut, M Rachik, MC Ho Ba Tho (2017). MRI-based Finite Element Modeling of Facial Mimics: a Case Study on the Paired Zygomaticus Major Muscles. Computer Methods in Biomechanics and Biomedical Engineering. In Press.

Candidate's profile:

Master student in the following fields: Computer engineering, Computational Biomechanics/Mechanics.

The candidate needs have the following experiences:

- ⇒ 3D geometric and physical modeling, 3-D physics engine, 3D Computer Vision
- ⇒ Numerical modeling (finite element, model reduction)
- ⇒ Expertise with Sofa framework (<https://www.sofa-framework.org/>) will be a plus
- ⇒ Advanced programming experiences in Visual C#/C++

Documents required to apply:

The closing date for the application is no later than 31 May 2017.

Send to tien-tuan.dao@utc.fr

- Curriculum vitae
- Master academic transcript
- Motivation letter
- At least two references and/or recommendation letters
- A statement of research experience and interests

Location:

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