



Soutenance d'une thèse de doctorat
De l'Université de Lyon
Opérée au sein de l'INSA Lyon
La soutenance a lieu publiquement

Candidat	MME GAO Sasa
Fonction	Doctorant
Laboratoire INSA	LAMCOS
Ecole Doctorale	ED162 : MEGA de Lyon
Titre de la thèse	« Development of a new 3D beam finite element with deformable section »
Date et heure de soutenance	05/04/2017 à 10h30
Lieu de soutenance	Amphithéâtre Ouest des Humanités (Villeurbanne)

Composition du Jury

Civilité	Nom	Prénom	Grade / Qualité	Rôle
M.	BINETRUY	Christophe	Professeur des Universités	Examineur
M.	HAMILA	Nahiène	Maître de Conférences	Examineur
M.	LE GROGNEC	Philippe	Habilité à Diriger des Recherches	Rapporteur
M.	SOULAT	Damien	Professeur des Universités	Rapporteur
MME	VIDAL-SALLE	Emmanuelle	Professeur des Universités	Directeur de thèse

Résumé

The new beam element is an evolution of a two nodes Timoshenko beam element with an extra node located at mid-length. That extra node allows the introduction of three extra strain components so that full 3D stress/strain constitutive relations can be used directly. The second step is to introduce the orthotropic behavior and carry out validation for large displacements/small strains based on Updated Lagrangian Formulation. A series of numerical analyses are carried out which shows that the enhanced 3D element provides an excellent numerical performance. Indeed, the final goal is to use the new 3D beam elements to model yarns in a textile composite preform. For this purpose, the third step is introducing contact behavior and carrying out validation for new 3D beam to beam contact with rectangular cross section. The contact formulation is derived on the basis of Penalty Formulation and Updated Lagrangian formulation using physical shape functions with shear effect included. An effective contact search algorithm is elaborated. And a consistent linearization of contact contribution is derived and expressed in suitable matrix form, which is easy to use in FEM approximation. Finally, some numerical examples are presented which are only qualitative analysis of contact and checking the correctness and the effectiveness of the proposed 3D beam element.