

Wrinkling during Forming of Multi-Layered Textile Composite

P. Boisse^{1, a)}, E. Guzman-Maldonado^{1, b)}, P. Wang^{2, c)}, N. Hamila^{1, d)},

¹*Université de Lyon, LaMCoS, INSA-Lyon, F-69621, France*

²*Université de Lille, ENSAIT, GEMTEX, F-59056 Roubaix, France*

^{a)}Corresponding author: Philippe.Boisse@insa-lyon.fr

^{b)} eduardo.guzman-maldonado@insa-lyon.fr

^{c)} peng.wang@ensait.fr

^{d)} nahiene.hamila@insa-lyon.fr

Abstract. When shaping a textile composite reinforcement, wrinkling is the main defect that may appear. When the woven reinforcement is multilayer with different orientations of the folds, the development of the folds is greatly increased. This phenomenon has been observed experimentally in several previous studies. This study shows that the numerical simulation of these forming processes using stress resultant shell elements is capable of accurately describing these multilayer forming processes and in particular the development of wrinkles. In the case of multilayer reinforcements where adjacent plies are oriented differently, numerical simulations show the development of areas where fibres in one direction are in compression which leads to the development of folds. It is shown that the friction coefficients play a major role in the development of wrinkles. The influence of the blank holders is also analyzed. Their use in this case does not appear to be an effective method.