



## INTERNSHIP PROGRAM FOR INTERNATIONAL STUDENTS

### INTERNSHIP SUBJECT FORM

Name of the Host Laboratory	Laboratoire d'informatique de l'École polytechnique
Website of the Host Laboratory	<a href="https://www.lix.polytechnique.fr/">https://www.lix.polytechnique.fr/</a>
Research Group	MAX team ( <a href="http://www.lix.polytechnique.fr/max/max-web/max/max-home.en.html">http://www.lix.polytechnique.fr/max/max-web/max/max-home.en.html</a> )
Internship Supervisor	Gleb POGUDIN
Internship Subject	Combinatorial algorithms for quadratizing differential equations
Student's level	<input checked="" type="checkbox"/> Advanced Undergraduate Students (3 <sup>rd</sup> or 4 <sup>th</sup> year) <input checked="" type="checkbox"/> Master's students (1 <sup>st</sup> or 2 <sup>nd</sup> year) <input checked="" type="checkbox"/> PhD students
Proposed Duration	<input checked="" type="checkbox"/> 3 months <input checked="" type="checkbox"/> 4 months <input checked="" type="checkbox"/> 5 months <input checked="" type="checkbox"/> 6 months
Prerequisites	Solid knowledge of discrete algorithm and data structures, good programming skills in Julia or Python
Internship description (max. 15 lines)	<p>Quadratization is a transformation aiming at converting a system of nonlinear differential equations into a system of differential equations with at most quadratic nonlinearities. Such transformation is used as a preprocessing step in model order reduction, reachability analysis, and synthetic biology.</p> <p>While coming from the world of differential equations, the problem of finding quadratization can be stated and solved in purely combinatorial terms. Recently, a branch-and-bound algorithm for solving this problem has been developed by Bychkov and Pogudin (<a href="https://arxiv.org/pdf/2103.08013.pdf">https://arxiv.org/pdf/2103.08013.pdf</a>).</p> <p>The goal of the internship will be to develop a faster algorithm to tackle larger problems coming from applications or extend the algorithm to larger classes of transformations (e.g., see Section 8 in the paper above.)</p>

The boxes marked with cross implies eligible