INTERNSHIP IN ELECTRIC POWER TRANSMISSION ON OVERHEAD AND UNDERGROUND WIRES

About the company:

$\mathcal{C}ompL\mathcal{e}X$ $\mathcal{B}iosystemS$ $\mathcal{I}$nc. is a new company with expertise in modeling & simulation of biological systems, and microelectronic for medical devices. In terms of products, its current portfolio is composed of a scientific data viewer, cell electrophysiology software and a simulation system for traveling electrochemical waves in excitable tissue. Services are related to these products. They include: cell line characterization, modeling & simulation for medical device prototyping, drug discovery, and the set up of computational platforms for Life Science & Engineering applications.

Anticipating the need of highly qualified personnel to support our technology transfer toward the modeling & simulation of traveling electromagnetic waves on overhead and underground wires, we are offering an internship in Electric Power Transmission for the summer period of 2019.

Context:

Predicting steady state and transient power distribution on overhead and underground wires when: power sources, loads, or line segments are added or removed has become an essential element of a planned management on the GRID.

Software tools to do so are part of a more general software suite that also includes: state monitoring, data visualization, and automated control of switches. that we term the Supervisory Control and Data Acquisition (SCADA). So far SCADA services providers include only large companies due to the overall complexity of this system. However the recent emergence of an Open Source SCADA, and its appeal to government agencies permit small business to compete for SCADA product & service offerings.

With anticipated support from NYSERDA, we plan to introduce modeling & simulation services on the prediction of power distribution that will overcome a number of limitations in the simulation of large scale distribution networks.

Our software suite generates data permitting to: (i) match power generation with load, (ii) carry out an orderly power transfer when multiple sources and/or loads are changed (iii) interpret voltage changes for readjustment of power distribution (iv) gracefully shutdown power distribution segments under excessive load (v) plan load shedding when power offering exceeds demand. The simulations are based on the solution of an array of partial differential equations. But predictions for the above tasks have appeal to service providers only for large scale distribution networks. The problem size increases rapidly with the number of connections, and because matrix solvers have intrinsic limitations with matrix size and structure, currently proposed solutions are unreliable even become unstable when applied to large scale networks. This is obviously problematic and we are proposing addressing such limitations with innovative solutions inspired from biological systems. Basically a large scale power distribution network has so many con-

nections that it can be represented with an equivalent two-dimensional membrane. Such representation confers structure to the array of differential equations which discretization, if performed with adaptive methods, generates matrices of smaller size and with a much smaller condition number. Our proprietary matrix solver can then reliably solve that matrix system and guarantee reliable predictions in a timely fashion. An additional advantage of this formulation is to facilitate the incorporation of distributed sources and load in large scale networks.

Qualifications:

- ◇ Bachelor's or Master's degree in Bioengineering, Electrical Engineering, or related fields that study electromagnetic wave propagation in various media.
- ◇ Be familiar with circuit theory and more specifically with the modeling of voltage and current distribution along transmission lines. This includes the solution method of the underlying differential equations.
- ◇ Have a basis on electric power transmission, i.e. good knowledge of Ampere's law, Faraday's law, and Gauss laws for electric and magnetic fields. Understand Poisson's equation and its application to electromagnetic wave transmission. How the mathematical expression of these laws are combined in Maxwell's equations. Have a basis on electromagnetic wave propagation with Maxwell's equations.
- ◇ Modeling & simulations being a central theme of the company, a solid background in applied Mathematics, specifically: vector calculus, numerical methods to solve ordinary and partial differential equations, and linear algebra, is essential.
- ◇ Well versed with the programming of scientific applications with procedural languages (e.g. C/C++).
- ◇ Desirable: a basis on electromagnetic wave propagation in wave guides.
- ◇ Impeccable written and verbal communications skills.

Duties:

- ◇ Gather physical characteristics of wires, and parameters of constitutive relations.
- ◇ Gather parameters necessary to represent sources and loads in a realistic manner.
- ◇ Simulate, with our software suite, electromagnetic wave transmission on one wire with a source and one to multiple load(s) along the wire. Simulate transients and steady after the source and loads are added or removed. For each case perform a convergence analysis.
- ◇ Repeat the above simulations for a star network configuration with the source at the center and the loads at the end of each transmission line. Simulate transients and steady after source and loads are added or removed. For each case perform a convergence analysis.
- ◇ Build a network of 100 and then a 1000 criscrossed wires along 2 orthogonal directions. The wires are interconnected at their intersection. Configure the simulation system to take into

consideration inductive coupling. Arbitrarily distribute sources and loads at the end of the trasmission lines. Add cases where load and sources are arbitrarily connected to internal grid nodes. Simulate transients and steady after sources and loads are added or removed. Study at least 5 cases. For each case perform a convergence analysis.

- ◇ Repeat the above simulations replacing the grid with a membrane. Simulate the same cases and for each perform a convergence analysis.
- ◇ Work closely with the developers
- ◇ Be in a position to make a demonstrations to potential customers.

To apply:

Follow the Openings tab. Register, then apply to the desired position. You will get instructions to upload cover letter and resume. Make sure your resume or cover letter includes at least 2 references. Address your application to Dr. Jacques Beaumont and clearly indicate the position you apply to.

ComplEX BiosystemS Inc. is an equal opportunity employer.