

JOB DESCRIPTION:

Computational Building Scientist / Hygrothermal Consultant (Short-Term Project Contract)

Company: Indow

Location: Remote or Pacific Northwest

Type: Short-Term Freelance / Consulting

Role Overview:

Indow is engineering an advanced, pressure-partitioned secondary glazing system for high-rise commercial deployment. To mathematically validate field performance before physical prototyping, our engineering team is developing a custom transient physics simulator in Python. It models coupled heat, air, and moisture (HAM) dynamics, specifically solving for high-rise pressure networks and active cavity sorption kinetics.

We are seeking a computational building scientist to conduct a rigorous peer-review of both our theoretical mathematics and our algorithmic implementation.

The Challenge:

Standard commercial building physics tools (like WUFI or THERM) do not offer the dynamic, timestep-level control we need for this specific assembly's changing boundary conditions. Our custom Python model utilizes Ordinary Differential Equation (ODE) solvers (`scipy.integrate.solve_ivp`) to manage sudden aerodynamic pressure changes, series-resistor orifice flow, and stiff moisture-transfer states without violating mass conservation.

We need an expert who understands the physics behind the simulation software to look at our equations and approach, and tell us where our assumptions are bulletproof, and where they break down. In a later phase we anticipate review of the functioning Python code.

Scope of Work:

Physics & Math Audit: Review our system of equations prior to Python coding. Validate our methodology for transient orifice flow networks, Sol-Air boundary temperatures, and moisture isotherm kinetics.

Algorithm Review: Audit the Python codebase to ensure the ODE solver handles algorithmic stiffness correctly (avoiding mathematical oscillations) and maintains exact mass balance during rapid weather fronts.

Boundary Calibration Check: Evaluate the model's outputs against extreme high-rise weather scenarios using TMY3 data to validate that the results align with real-world building physics.

Ideal Qualifications:

- Deep expertise in transient hygrothermal (HAM) physics, cavity airflow, and mass-transfer kinetics.
- Strong proficiency in Python, specifically numerical integration (scipy / numpy).
- Academic or professional background in computational building science, façade simulation, or mechanical engineering.
- Familiarity with aerodynamic pressure models, building stack effects, and mechanical pressurization.

Details:

This is a paid, short-term consulting engagement.

An NDA will be required prior to sharing the mathematical architecture and codebase. If interested, please reach out to sam@indowwindows.com with a brief summary of your computational modeling experience and your hourly consulting rate.