STUDENT VERSION
Tank Interrupt Mixing

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STATEMENT

Water containing 2 kg of salt per liter (L) is poured into a tank at a rate of 1 L/min, and the well-stirred mixture leaves at the same rate. After 10 min, the process is stopped and fresh water is poured into the tank at a rate of 1 L/min, with the new mixture leaving at 1 L/min. We seek to model this situation in order to determine the amount (kg) of salt in the tank at the end of 20 min if there were 100 L of pure water initially in the tank.

Activities

1. Build a mathematical model for the amount of salt in kg in the tank at time \( t \) in min with two parts, first over the time interval \([0, 10]\) min and then over the time interval \([10, 20]\) min. You can assume instantaneous mixing of the two different solutions.

2. Build a mathematical model for the amount of salt in kg in the tank at time \( t \) in min using the Heaviside or Unit Step functions to represent the sudden change in input water types and apply Laplace Transforms and Inverse Laplace Transforms to determine the amount of salt in the tank over the entire interval \([0, 20]\) min. Then compare your results with Activity 1.