School of Electrical, Computer and Energy Engineering

M.S. Final Oral Defense
One-Dimensional Fast Transient Simulator for Modeling CdS/CdTe Solar Cells

by
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Abstract
Solar energy, including solar heating, solar architecture, solar thermal electricity and solar photovoltaics, is one of the primary alternative energy sources to fossil fuel. Being one of the most important techniques, significant amount of research had been conducted into solar cells efficiency improvement. Simulation of various structures and materials of solar cells provides better and deeper understanding of the device operation and the ways to improve their efficiency.

In this work a fast one dimensional time-dependent/steady-state drift-diffusion simulator, accelerated by adaptive non-uniform mesh and automatic time-step control, for modeling solar cells has been developed and has been used to simulate CdS/CdTe solar cell. These models are used to reproduce transients of carrier transport in response to step-function signals of different bias and varied light intensity. The time-step control models are also used to help convergence in steady-state simulations where harsh material constants, such as carrier lifetimes in the order of nanosecond and carrier mobility in the magnitude of 100 cm²/Vs, need to be applied.