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Analysis of Wind Forces on Roof-Top Solar Panel[1] YOGENDRA PANTA, GANESH KUDAV, Department of Mechanical & Industrial Engineering, Youngstown State University, Youngstown, Ohio — Structural loads on solar panels include forces due to high wind, gravity, thermal expansion, and earthquakes. International Building Code (IBC) and the American Society of Civil Engineers are two commonly used approaches in solar industries to address wind loads. Minimum Design Loads for Buildings and Other Structures (ASCE 7-02) can be used to calculate wind uplift loads on roof-mounted solar panels. The present study is primarily focused on 2D and 3D modeling with steady, and turbulent flow over an inclined solar panel on the flat based roof to predict the wind forces for designing wind management system. For the numerical simulation, 3-D incompressible flow with the standard k-ε was adopted and commercial CFD software ANSYS FLUENT was used. Results were then validated with wind tunnel experiments with a good agreement. Solar panels with various aspect ratios for various high wind speeds and angle of attacks were modeled and simulated in order to predict the wind loads in various scenarios. The present study concluded to reduce the strong wind uplift by designing a guide plate or a deflector before the panel.

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