7. CONCLUSION

This paper presents the comparison of P&O MPPT, P&O besed PI and P&O/EL-PBC in relation to their performance. The results indicate that P&O/PI method has low efficiency because of its lack of speed in tracking the MPPT. But, the P&O/EL-PBC method shows the effectiveness of the last to eliminate the oscillations and achieve less response time successfully

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REFERENCES

[1] Tang, Z.B., Deng, Y.D., Su, C.Q., Shuai, W.W., Xie, C.J. (2015). A research on thermoelectric generator's electrical performance under temperature mismatch conditions for automotive waste heat recovery system. Case Studies in Thermal Engineering, 5: 143-150. https://doi.org/10.1016/j.csite.2015.03.006

[2] Tsai, H.L., L, J.M. (2009). Model building and simulation of thermoelectric module using Matlab/Simulink. Journal of Electronic Materials, 39(9): 2105-2111. https://doi.org/10.1007/s11664-009-0994-x

[3] Gao, H.B., Huang, G.H., Li, H.J., Qu, Z.G., Zhang, Y.J. (2016). Development of stove-powered thermoelectric generators: A review. Applied Thermal Engineering, 9: 297-310. https://doi.org/10.1016/j.applthermaleng.2015.11.032

[4] Ludek, J., Zdenek, H. (2015). Power management electronics for thermoelectric energy harvesting systems. International Journal Engineering, 13(1): 183-186.

[5] Paraskevas, A., Koutroulis, E. (2016). A simple maximum power point tracker for thermoelectric generators, Energy Conversion and Management, 108: 355-365. https://doi.org/10.1016/j.enconman.2015.11.027

[6] Singh, M., Bhukesh, S.K., Vaishnava, R. (2015). Modeling and simulation of solar thermoelectric generator. IOSR Journal of Electrical and Electronics Engineering, 10(3): 71-76. 10.9790/1676-10337176

[7] Toualbia, A., Tadjine, M. (2017). Perturb and observe maximum power point tracking based passivity approach for thermoelectric generator. The Mediterranean Journal of Measurement and Control, 13(1): 355-365.

[8] Abouda, S., Nollet, F., Essounbouli, N., Chaari, A., Koubaa, Y. (2013). Design, simulation and voltage control of standalone photovoltaic system based MPPT: application to a pumping system. International Journal of Renewable Energy Research, 3(3): 539-549.

[9] Sreekala, P. Ramkumar, A. (2017). Performance analysis of thermoelectric generator with different controllers. Technical Research Organization India, 4(11): 13-16. https://doi.org/10.3390/e17117387

[10] Belabbes, B., Lousdad, A., Meroufel, A., Larbaoui, A. (2013). Simulation and modelling of passivity based control of PMSM under controlled voltage. Journal of Electrical Engineering, 64(5): 298-304. https://doi.org/10.2478/jee-2013-0043

[11] Tofighi, A., Kalantar, M. (2013). Interconnection and damping assignment and Euler-Lagrange passivity-based control of photovoltaic/battery hybrid power source for stand-alone applications. Journal of Zhejiang University- Science (Computers & Electronics), 12(9): 774-786. https://doi.org/10.1631/jzus.c1000368

NOMENCLATURE

Symbol	Significance
P&O	Perturb and Observe,
MPPT	Maximum Power Point Tracking,
PBC	Passivity based control,
P&O/PBC	Perturb and Observe based passivity,
TEM	Thermoelectric Module,
EL-PBC	the Euler Lagrange passivity based control,
V_{oc}	The open-circuit thermoelectric potential,
α	the Seebeck coefficient,
ΔT	is the temperature difference across the two junctions,
ρ	the electrical resistivity,
K	the thermal conductivity,
V_g	the generated Seebeck voltage,
V	the voltage of TEM,
R_g	total electrical resistance of TEM,
V_m	The maximum voltage,
P	The power of the load,
V_{ch}	Voltage of the load,
L	The Lagrangian of the system,
T	the electric field energy,
D	the Rayleigh dissipation,
F_q	exogenous inputs to the system,
q_L	the electrical charge on the inductor,
q_C	the electrical charge on the capacitor,
μ	the duty cycle of the converter,
R_b	The injected damping matrix,
R_d	the desired error dissipation,
$\tilde{x}$	the error state vector,
X_{1d}	the desired inductor current,
X_{2d}	the output MPPT P&O voltage delivered,
$H(x)$	the energy storage function,
$H_d(x)$	the energy storage function desired