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# Non-linear energy harvesting based power splitting relaying in full-duplex AF and DF relaying networks: system performance analysis

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**Abstract.** Wireless power transfer is considered as a novel solution for energy harvesting in wireless communication networks. In this paper, the system performance of the non-linear energy harvesting based power splitting relaying in the full-duplex relaying sensor network is investigated. We considered the system model network with one source, one destination, and one relay node in both the amplify-and-forward and decode-and-forward modes. The closed-form expressions of the system outage (OP) are analysed and derived for verifying system performance. Then, the correctness of the OP closed-form expression is verified by using the Monte Carlo simulation. Furthermore, the influence of the primary system parameters on the system OP is suggested and investigated. The research results indicated that the simulation curves and the analytical curves overlapped, verifying the correctness of the analytical expressions.

**Key words:** amplify-and-forward, decode-and-forward, outage probability, non-linear energy harvesting, sensors network.

**Abbreviations and symbols**

| | |
|---|---|
| AF | Amplify-and-forward |
| AWGN | Additive white Gaussian noise |
| DF | Decode-and-forward |
| EH | Energy harvesting |
| FD | Full-duplex |
| IT | Information transformation |
| NEH | Non-linear energy harvesting |
| OP | Outage probability |
| PS | Power splitting |
| RF | Radiofrequency |
| RV | Random variable |
| SINR | Signal to interference noise ratio |
| SP | Success probability |
| SWIPT | Simultaneous wireless information and power transfer |
| $\rho$ | Power splitting factor, $0 < \rho < 1$ |
| $\eta$ | Energy conversion efficiency, $0 < \eta \leq 1$ |
| $P_{th}$ | Saturation threshold of the rechargeable power |
| $\gamma_{th}$ | Threshold of the system |
| $\Gamma(\bullet)$ | Incomplete gamma function |
| $\lambda_{SR}$ | Mean of $\lvert h_{SR}\rvert^2$ |
| $\lambda_{RD}$ | Mean of $\lvert h_{RD}\rvert^2$ |
| $\Omega_{RR}$ | Variance of $\lvert h_{RR}\rvert^2$ |
| $\beta$ | Amplification factor |
| $P_S$ | Transmit power of the source |
| $T$ | Total time of processing |
| $\psi$ | Ratio of energy $P_s$ to variance $N_0$ |

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