Three main ways can be followed to design for system reliability, namely component reliability allocation, redundancy allocation (active or standby) and reliability-redundancy allocation. Standby redundancy provides higher reliability than the active one, but its modelling is more complicated. This paper considers the system reliability-redundancy allocation with cold-standby strategy and proposes a new approach to its solution, called enhanced nest cuckoo optimization algorithm (ENCOA). ENCOA uses more realistic procedures than the cuckoo optimization algorithm (COA) in terms of egg laying and survivor cuckoos, based on advanced studies of the European cuckoo's lifestyle available in the literature. Four case studies are investigated in order to highlight the applicability and the performance of the proposed approach. The results are compared to those obtained in previous works of literature