# Abstract

In this research, we propose the novel spectrum sensing techniques for time reduction in cognitive radio (CR) network for smart grid (SG) communication. CR network is received highly consideration to the communications infrastructure for SG because CR has been proposed to solve the spectrum scarcity problem by offering several advantages to utilize spectrum opportunely with dynamic spectrum management techniques. CR network has two important actors: Primary user (PU) and Secondary user (SU). PU is the owner of a licensed channel that has the priority to use the spectrum and SU is the occasional user that is responsible for sensing the licensed spectrum, identifying the unused channels in the absence of PU. CR system has four main functions including spectrum sensing, spectrum management, spectrum mobility, and spectrum sharing. To achieve this requirement, the SU need to have the capability to detect the availability of spectrum bands for possible utilize and aware of the PU reclaim rights of usage which is referred to "spectrum sensing". Thus, spectrum sensing is the function of cognitive radio that is playing a major role for efficiency spectrum usage.

In this research, we propose four spectrum sensing schemes in CR network for SG communication system. First, we propose fast spectrum sensing with coordinate system (FSC). FSC is knowledge-based spectrum sensing method. This novel technique decomposes a spectrum with high complexity into a new coordinate system and it uses these features in its PU detection process. Not only is the space of a buffer that is used to store information about a PU reduced, but also the sensing process is fast. Second, we propose double constraints adaptive energy detection (DCAED) for spectrum sensing. DCAED is blind spectrum sensing technique. This method adapts the threshold based on 2 accuracy of performance metrics. By using probability of detection and probability of false alarm as the target accuracy performance metrics, DCAED overcomes a demerit of ED in tradeoff between probability of detection and probability of false alarm when the system threshold is set by selecting only probability of detection or probability of false alarm. Third, we proposed two-stage spectrum sensing scheme exploits the merits of ED, MME and CAV techniques to determine the existence of the primary user. The ED performs spectrum sensing within a short time and offers a reliable detection at high SNRs condition. MME and CAV are robust to noise power uncertainty. Due to the combination of these techniques, the proposed schemes offer much more reliable detection when the uncertainty of noise power occurs. Finally, we propose modified- fast spectrum sensing with coordinate system (MFSC), to perform spectrum sensing under path loss effect and noise uncertainty.



**Keyword:** Cognitive radio, Spectrum sensing, PCA, Noise uncertainty, Path loss effect