Title: Tracking Periodic Voltage Sags via Synchrophasor Data in a Geographically Bounded Service Territory

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Summary of proposed presentation (1-3 paragraphs):

Besides forced oscillations, which are usually a result of instability and have significantly high amplitudes, real world power systems have other, low magnitude periodic behaviors. These are usually controlled periodic inputs from processes such as industrial load duty cycle, that are not typically a major stability concern, although they do deteriorate dynamic system performance. Regardless, a system operator/planner needs to be aware of these as they could potentially play a role in exciting, triggering or interacting with other system dynamics or undesirable phenomena. The main challenge in working with these types of period behaviors is that these do not comply with the traditional characterization of modes as these are usually not band limited, i.e., their power spread is across multiple frequencies (usually with harmonics).

In the present work, we study one such phenomenon in the form of a periodic voltage sags observed in Dominion's 500 kV network. A methodology is proposed that utilizes traditional spectral analysis techniques to analyze a set of spectral peaks, as opposed to only one, and combine their results to identify the most impacted substations as well as the dominant propagation path, which helps localize the source. In this context, because most utilities operate and have data only from a bounded service territory, we cater to these spatial bounds within the proposed method to identify the tie-line in a system which is viewed as the source into the bounded service territory. To demonstrate the effectiveness of this approach, it is applied to ambient PMU measurements from the Dominion System.

Statement of novelty or impact, answering the question why would the NASPI community benefit from receiving this presentation? (1 paragraph): The novelty of this work lies in the atypical nature of the oscillation mode and how to deal with it in the context of oscillation source location when measurement data is only available in a bounded region. This allows the utility to identify the "source" into the system, e.g. a tie-line connecting to another network, where the visibility of the oscillation ends. Being able to identify such interface points would allow utilities to collaborate in analyzing such abnormal conditions more easily, to address them and mitigate them, without the need of performing a system-wide synchrophasor analysis study.