Alyssa N Adams and Bonnie C Jacob* (bcjntm@rit.edu). Failed zero forcing on oriented and directed graphs: results, applications, and open questions.

Let $\Gamma$ be a simple directed graph with vertex set $V$ and edge set $E$ where $n = |V|$, and each edge is assigned one or more orientations, $e = (u, v)$ or $e = (v, u)$. The closed out-neighborhood of $u \in V$ is $N^+(u) = \{u\} \cup \{v : v \in V \text{ and } (u, v) \in E\}$. For $S \subseteq V$, $B^0(S) := S$ and for $i = \{0, 1, \ldots\}$, $B^{i+1}(S) := B^i \cup \{w : \{w\} = N^+[v] \setminus B^i(S) \text{ for some } v \in B^i(S)\}$. If $B^i(S) \neq V$ for any $i$, then $S$ is a failed zero forcing set. In this talk, we introduce the failed zero forcing number $F(\Gamma)$ on a directed graph, which is the maximum cardinality of any failed zero forcing set in $\Gamma$. We characterize oriented graphs that have $F(\Gamma) < Z(\Gamma)$ and directed graphs with $F(\Gamma) = n - 1$, $F(\Gamma) = n - 2$, and $F(\Gamma) = 0$. We also show that for any integer $n \geq 3$ and any non-negative integer $k$ with $k < n$, there exists a directed graph $\Gamma$ whose underlying undirected graph is a cycle with $F(\Gamma) = k$. Finally, we discuss potential applications of the failed zero forcing number and some open questions. (Received September 12, 2019)