

We say that a graph admits a nowhere-zero  $k$ -flow if we can assign a direction and a positive integer ( $\leq k$ ) as a flow to each edge so that total in-flow into  $v$  and total out-flow from  $v$  are equal for each vertex  $v$ . In 1954, Tutte conjectured that every bridgeless graph admits a nowhere-zero 5-flow and the conjecture is still open. Kochol in his recent papers introduces a computational method how to prove that a minimal counterexample cannot contain short circuits (up to length 10). In this Thesis, we provide a comprehensive view on this method. Moreover, since Kochol does not share his implementation and in order to independently verify the method, we provide our source code that validates Kochol's results and extend them: we prove that any minimal counterexample to the conjecture does not contain any circuit of length less than 12.