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A new analysis of the rotationally symmetric flow in the presence of an infinite rotating disk

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**Highlights**

- Von Kármán swirling viscous flow produced by an infinite rotating disk is investigated, both analytically and numerically, when the fluid at infinity is in a state of rigid body rotation.
- The analytical solution branch of the problem considered are shown conveniently when  $0 \leq s \leq 1$ .
- For  $-0.1575 \leq s < 0$ , the forward shooting technique, different from previous conclusions with a failure of solutions, can still give effectively the first solution branch of dual solutions by Zandbergen and Dijkstra who adopted a backward shooting technique. The solution branches of von Kármán swirling viscous flow are enriched.
- A possible explanation is made from both mathematical and physical perspectives.

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