**T**opological **M**ethods in **N**onlinear **A**nalysis
Volume 55, No. 1, 2020, 37–49
DOI: 10.12775/TMNA.2019.083



# EXISTENCE OF PERIODIC SOLUTION FOR A TUMOR GROWTH MODEL WITH VACCINE INTERACTION

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Abstract. This paper is devoted to the study of existence of positive periodic solutions of a tumor-immune competition model with vaccine interaction. By using the continuation theorem of coincidence degree theory developed by Gaines and Mawhin, we establish the sufficient conditions for the existence of periodic solutions.

## 1. Introduction

Cancer is a class of more than 100 varied diseases portrayed by the uncontrolled growth of abnormal cells in the body. Though cancer has been known since the early decades, the interactions between tumor cells and the immune system have been a great interest for experimentalists and mathematicians recently. The main goal for these scientists is to study the treatments of cancer disease by developments through medical methods for timely diagnosis, radiotherapy, chemotherapeutic medications, vaccine treatment and immunotherapy. Currently, developments in these studies emphasize that the immune system plays a fundamental role in host defense against tumor and hence, in past decades immunotherapy has become an important part of treating cancer (see [12] and [11]).

2020 *Mathematics Subject Classification.* Primary: 34A34, 34C25; Secondary: 47H11, 93-10.

*Key words and phrases.* Coincidence degree theory; tumor-immune system; periodic solution.