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**Phase diagrams of the Potts model on the Cayley tree with competing binary interactions up to the third nearest-neighbour generations**

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**Abstract**
We are interested to investigate whether the presence of the third nearest-neighbour would give any significant effect on the generation of the phase diagrams. For this purpose, we analyze the phase diagrams of the Potts model with prolonged competing binary interactions J2 and J3 on the Cayley tree up to the third nearest-neighbour generations. We derive the recurrence system of equations and investigate the phase diagrams for several ranges of the competing parameters. Then, we conduct a numerical analysis by carrying out an iteration scheme on the phase diagrams. For some non-zero parameter J3, we found the additional phases of period 5, 6, 9, and 11, along with the ferromagnetic, antiphase, paramagnetic, antiferromagnetic and modulated phase. © 2019 Author(s).

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