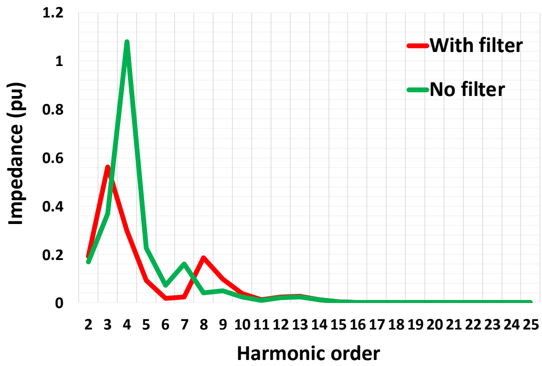

Fig. 7. Impedance-frequency response before and after connecting the 7th order tuned filter.

Based on Fig. 7, one notes that although the filter has changed the resonance characteristics of the network presented herein, the 3rd order resonance resulting from the filter connection was not sufficient to violate the established limits.

Moreover, it should be pointed out that the simulated cases covered different loading conditions (light, medium and heavy) from 2020 to 2024, as well as the N-1 contingency analysis covering up to the 3rd PCC neighborhood. For this reason, it can be inferred that, among the solutions herein presented, the 7th order harmonic filter presented itself as the most suitable solution for maintaining harmonic distortions under the established limits, since it was able to reduce the most severe distortions and eliminate the need for using multiple filters.

5. Conclusion

The objective of this paper was to evaluate the impacts of connecting passive tuned harmonic filters on the grid-resonance characteristics and the overall harmonic distortions from a wind farm. In this context, from measurements from a Brazilian wind power plant, computational studies were performed in accordance with national regulations.

In this sense, two case studies were evaluated in order to mitigate the 4th order harmonic distortions arising from the wind farm. The first study was based on the insertion of a tuned harmonic filter on the violated order. The second solution was based on different filter tunings in order to identify the best solution to address this matter.

The results have shown that the 4th order filter caused a resonance in the 3rd order, implying the limit violation at this order. Therefore, after evaluating the insertion of different tuned harmonic filters, one finds that the 7th order filter was able to solve the problem focused upon herein.

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