There are several automatic music composition algorithms that generate a classical music melody or Jazz and Blues chords and progressions. These algorithms often work by applying a series of music rules which are explicitly provided in order to determine the sequence of the exit codes. In other cases, the algorithms use generation techniques based on Markov Models. The objective of this article is to present an algorithm for the automatic composition of classical tonal music, based on a self-learning model that combines De La Motte's theory of Functional Harmony in a Markov process. This approach has the advantage of being more general compared to the explicit specification of rules. The article is going to demonstrate the effectiveness of the method by means of some examples of its production and is going to indicate ways to improve the method.