Abstract

This thesis provides a set of computational methods for analyzing Milton Babbitt's (1916–2011) 12-tone serial music and generating novel musical works in his style. A key component of the proposed methods is their basis in the actual techniques Babbitt himself used to compose his later works, supplemented by hypotheses in the form of algorithms regarding the specific processes that he used to apply these techniques. Two of these techniques, the all-partition array and time-point system, combine to form the musical surface of many of these works. Considerable attention in this thesis is paid to the structure found in the all-partition array. The problem of generating an all-partition array is challenging. However, solving this problem is necessary if one's aim is to model Babbitt's compositional process, as it greatly constrains the many other possible musical parameters in his works. A significant contribution of the work presented here is the demonstration that this problem can be formulated as a special case of the set-covering problem (SCP), a familiar problem in computer science and operations research. This thesis presents three methods for generating an all-partition array based on procedural backtracking with heuristics, integer programming (IP) and constraint programming (CP). A solution was found to the smallest instance of this problem using the proposed CP model. Generating the larger instances of the all-partition array found in Babbitt's music remains an unsolved problem. Finally, a method is proposed for generating from an all-partition array novel musical works based on the time-point system. This method has been used to automatically generate a symbolic score representation of a novel work for flute and string quartet, where the generated parameters of this piece include pitch, voice, onset, duration, dynamic level and meter. It is precisely because a computational method has been adopted here that the true difficulty in understanding Babbitt's music, his compositional process and the problems therein have been made clear.