Involuntary contractions during bladder filling can cause overactive bladder disorder, and underactive bladder can involve weak or incomplete contractions during voiding. Actin-myosin crossbridges in detrusor smooth muscle (DSM) are responsible for contracting and voiding the bladder. The tension produced by DSM is the sum of its preload and active tensions. Previous studies indicate that actin-myosin crosslinks are involved in adjustable preload tension, which is characterized by a length-preload tension curve that shifts along the length axis as a function of strain history and activation history. In addition, DSM exhibits length adaptation which is characterized by a length-active tension curve that can exhibit a similar shift. Actin-myosin crossbridges are also responsible for spontaneous rhythmic contractions that may occur during bladder filling. Studies indicate that rhythmic contractions may participate in the mechanical regulation of both adjustable preload tension and length adaptation. However, the mechanical mechanisms by which actin-myosin interactions enable these interrelated behaviors remain to be determined and were the primary focus of this study. A mechanical model with tension-generating actin-myosin crossbridges and tension-supporting actin-myosin crosslinks was developed, and model simulations demonstrate the coupled mechanical behaviors of adjustable preload tension, spontaneous rhythmic contractions, and length adaptation observed in DSM. Improved understanding and models of bladder biomechanics may enable the identification of specific targets for the development of new treatments for overactive and underactive bladder disorders.