Abstract

This paper addresses a thermodynamic analysis of steam injection in the combustion chamber of a large size gas turbine considering blades cooling and NOx emissions. Since heat transfer from the mixture of gas and steam is higher than the one from gas alone, the blades would be inefficiently cooled and their material might be affected. Thus, to preserve their temperature below the required limit, two solutions are proposed; the first keeps combustor discharge temperature at its initial value and increases the quantity of coolant and the second keeps the initial quantity of coolant and decreases the combustor discharge temperature. The results show that both solutions lead to the enhancement of performances but the first solution gives better results and allows producing a maximal steam/gas fraction of 14% while for the second solution this fraction is 11%. The power is increased from 270 MW to 388 MW and 302 MW respectively for the first and the second solution and the efficiency from 38% to 42.7% and 40.2%. The results have also shown that the amount of NOx produced is significantly decreased and may reach a value of 10 ppm for the first solution and 14 ppm for the second one.