

ABSTRACTS

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THE CONVEX COMBINATIONS OF QUADRATIC OPERATORS ON S^2

Mamurov B.Zh.

Bilkent State University, Ankara, Uzbekistan
 mamurov_b@mail.ru

Quadratic operators attract the attention of specialists in various fields of mathematics and its applications (see for example [1], [2]). We will use the definition and notation of the references [1], [2] on the two-dimensional simplex the following quadratic stochastic operator was studied: $V_1 : S^2 \rightarrow S^2$, $V_2(x_1, x_2, x_3) = (x_1, x_2, x_3)$ where

$$x_1 = x_1^2 + 2x_1x_2, \quad x_2 = x_2^2 + 2x_1x_3, \quad x_3 = x_3^2 + 2x_2x_3.$$

It is proved that $M_1(1, 0, 0)$, $M_2(0, 1, 0)$, $M_3(0, 0, 1)$, $C(1/3, 1/3, 1/3)$ are fixed points of the operator V_1 . Note that in [1] by author studied the following quadratic stochastic operator V_2 :

$$V_2 : \begin{cases} x_1 = 1/3x_1^2 + 1/3x_2^2 + 1/3x_3^2 + 2x_1x_2 \\ x_2 = 1/3x_1^2 + 1/3x_2^2 + 1/3x_3^2 + 2x_2x_3 \\ x_3 = 1/3x_1^2 + 1/3x_2^2 + 1/3x_3^2 + 2x_1x_3 \end{cases}$$

It is proved that the operator V_2 has a unique fixed point C and it is a regular operator. In present paper, we shall consider a convex combination of the operators V_1 and V_2

$$V_\lambda : S^2 \rightarrow S^2, \quad V_\lambda = (1 - \lambda)V_1 + \lambda V_2, \quad 0 \leq \lambda \leq 1.$$

It is easy to see that the operator V_λ has the form:

$$V_\lambda : \begin{cases} x_1 = (1 - 2\lambda/3)x_1^2 + \lambda/3x_2^2 + \lambda/3x_3^2 + 2x_1x_2 \\ x_2 = \lambda/3x_1^2 + (1 - 2\lambda/3)x_2^2 + \lambda/3x_3^2 + 2x_2x_3 \\ x_3 = \lambda/3x_1^2 + \lambda/3x_2^2 + (1 - 2\lambda/3)x_3^2 + 2x_1x_3 \end{cases}$$

Obviously, the operator V_λ is also a quadratic stochastic operator.

Theorem. For the operator V_λ the following statements are true:

- a) The operator V_λ has a unique fixed point $C(1/3, 1/3, 1/3)$;
- b) if $\lambda = (\sqrt{3} - \sqrt{6})/2$ then the fixed point C is a non-attracting point;
- c) if $0 < \lambda < (\sqrt{3} - \sqrt{6})/2$ then the fixed point C is a repelling point;
- d) if $(\sqrt{3} - \sqrt{6})/2 < \lambda < 1$ then C is an attracting point.

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