ISSN (Print): 2077-9879
ISSN (Online): 2617-2658

Eurasian Mathematical Journal

2021, Volume 12, Number 3

Founded in 2010 by
the L.N. Gumilyov Eurasian National University
in cooperation with
the M.V. Lomonosov Moscow State University
the Peoples' Friendship University of Russia (RUDN University)
the University of Padua

Starting with 2018 co-funded
by the L.N. Gumilyov Eurasian National University
and
the Peoples' Friendship University of Russia (RUDN University)

Supported by the ISAAC
(International Society for Analysis, its Applications and Computation)
and
by the Kazakhstan Mathematical Society

Published by

the L.N. Gumilyov Eurasian National University
Nur-Sultan, Kazakhstan

EURASIAN MATHEMATICAL JOURNAL

Editorial Board

Editors–in–Chief

V.I. Burenkov, M. Otelbaev, V.A. Sadovnichy

Vice–Editors–in–Chief

K.N. Ospanov, T.V. Tararykova

Editors

Sh.A. Alimov (Uzbekistan), H. Begehr (Germany), T. Bekjan (China), O.V. Besov (Russia), N.K. Bliev (Kazakhstan), N.A. Bokayev (Kazakhstan), A.A. Borubaev (Kyrgyzstan), G. Bourdaud (France), A. Caetano (Portugal), M. Carro (Spain), A.D.R. Choudary (Pakistan), V.N. Chubarikov (Russia), A.S. Dzumadildaev (Kazakhstan), V.M. Filippov (Russia), H. Ghazaryan (Armenia), M.L. Goldman (Russia), V. Goldshtein (Israel), V. Guliyev (Azerbaijan), D.D. Haroske (Germany), A. Hasanoglu (Turkey), M. Huxley (Great Britain), P. Jain (India), T.Sh. Kalmenov (Kazakhstan), B.E. Kangyzhin (Kazakhstan), K.K. Kenzhibaev (Kazakhstan), S.N. Kharin (Kazakhstan), E. Kissin (Great Britain), V. Kokilashvili (Georgia), V.I. Korzyuk (Belarus), A. Kufner (Czech Republic), L.K. Kussainova (Kazakhstan), P.D. Lamberti (Italy), M. Lanza de Cristoforis (Italy), F. Lanzara (Italy), V.G. Maz'ya (Sweden), K.T. Mynbayev (Kazakhstan), E.D. Nursultanov (Kazakhstan), R. Oinarov (Kazakhstan), I.N. Parasidis (Greece), J. Pečarić (Croatia), S.A. Plaksa (Ukraine), L.-E. Persson (Sweden), E.L. Presman (Russia), M.A. Ragusa (Italy), M.D. Ramazanov (Russia), M. Reissig (Germany), M. Ruzhansky (Great Britain), M.A. Sadybekov (Kazakhstan), S. Sagitov (Sweden), T.O. Shaposhnikova (Sweden), A.A. Shkalikov (Russia), V.A. Skvortsov (Poland), G. Sinnamon (Canada), E.S. Smailov (Kazakhstan), V.D. Stepanov (Russia), Ya.T. Sultanaev (Russia), D. Suragan (Kazakhstan), I.A. Taimanov (Russia), J.A. Tussupov (Kazakhstan), U.U. Umirbaev (Kazakhstan), Z.D. Usmanov (Tajikistan), N. Vasilevski (Mexico), Dachun Yang (China), B.T. Zhumagulov (Kazakhstan)

Managing Editor

A.M. Temirkhanova

© The L.N. Gumilyov Eurasian National University

Aims and Scope

The Eurasian Mathematical Journal (EMJ) publishes carefully selected original research papers in all areas of mathematics written by mathematicians, principally from Europe and Asia. However papers by mathematicians from other continents are also welcome.

From time to time the EMJ publishes survey papers.

The EMJ publishes 4 issues in a year.

The language of the paper must be English only.

The contents of the EMJ are indexed in Scopus, Web of Science (ESCI), Mathematical Reviews, MathSciNet, Zentralblatt Math (ZMATH), Referativnyi Zhurnal – Matematika, Math-Net.Ru.

The EMJ is included in the list of journals recommended by the Committee for Control of Education and Science (Ministry of Education and Science of the Republic of Kazakhstan) and in the list of journals recommended by the Higher Attestation Commission (Ministry of Education and Science of the Russian Federation).

Information for the Authors

Submission. Manuscripts should be written in LaTeX and should be submitted electronically in DVI, PostScript or PDF format to the EMJ Editorial Office through the provided web interface (www.enu.kz).

When the paper is accepted, the authors will be asked to send the tex-file of the paper to the Editorial Office.

The author who submitted an article for publication will be considered as a corresponding author. Authors may nominate a member of the Editorial Board whom they consider appropriate for the article. However, assignment to that particular editor is not guaranteed.

Copyright. When the paper is accepted, the copyright is automatically transferred to the EMJ. Manuscripts are accepted for review on the understanding that the same work has not been already published (except in the form of an abstract), that it is not under consideration for publication elsewhere, and that it has been approved by all authors.

Title page. The title page should start with the title of the paper and authors' names (no degrees). It should contain the Keywords (no more than 10), the Subject Classification (AMS Mathematics Subject Classification (2010) with primary (and secondary) subject classification codes), and the Abstract (no more than 150 words with minimal use of mathematical symbols).

Figures. Figures should be prepared in a digital form which is suitable for direct reproduction.

References. Bibliographical references should be listed alphabetically at the end of the article. The authors should consult the Mathematical Reviews for the standard abbreviations of journals' names.

Authors' data. The authors' affiliations, addresses and e-mail addresses should be placed after the References.

Proofs. The authors will receive proofs only once. The late return of proofs may result in the paper being published in a later issue.

Offprints. The authors will receive offprints in electronic form.

Publication Ethics and Publication Malpractice

For information on Ethics in publishing and Ethical guidelines for journal publication see http://www.elsevier.com/publishingethics and http://www.elsevier.com/journal-authors/ethics.

Submission of an article to the EMJ implies that the work described has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis or as an electronic preprint, see http://www.elsevier.com/postingpolicy), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder. In particular, translations into English of papers already published in another language are not accepted.

No other forms of scientific misconduct are allowed, such as plagiarism, falsification, fraudulent data, incorrect interpretation of other works, incorrect citations, etc. The EMJ follows the Code of Conduct of the Committee on Publication Ethics (COPE), and follows the COPE Flowcharts for Resolving Cases of Suspected Misconduct (http://publicationethics.org/files/u2/NewCode.pdf). To verify originality, your article may be checked by the originality detection service CrossCheck http://www.elsevier.com/editors/plagdetect.

The authors are obliged to participate in peer review process and be ready to provide corrections, clarifications, retractions and apologies when needed. All authors of a paper should have significantly contributed to the research.

The reviewers should provide objective judgments and should point out relevant published works which are not yet cited. Reviewed articles should be treated confidentially. The reviewers will be chosen in such a way that there is no conflict of interests with respect to the research, the authors and/or the research funders.

The editors have complete responsibility and authority to reject or accept a paper, and they will only accept a paper when reasonably certain. They will preserve anonymity of reviewers and promote publication of corrections, clarifications, retractions and apologies when needed. The acceptance of a paper automatically implies the copyright transfer to the EMJ.

The Editorial Board of the EMJ will monitor and safeguard publishing ethics.

The procedure of reviewing a manuscript, established by the Editorial Board of the Eurasian Mathematical Journal

1. **Reviewing procedure**

1.1. All research papers received by the Eurasian Mathematical Journal (EMJ) are subject to mandatory reviewing.

1.2. The Managing Editor of the journal determines whether a paper fits to the scope of the EMJ and satisfies the rules of writing papers for the EMJ, and directs it for a preliminary review to one of the Editors-in-chief who checks the scientific content of the manuscript and assigns a specialist for reviewing the manuscript.

1.3. Reviewers of manuscripts are selected from highly qualified scientists and specialists of the L.N. Gumilyov Eurasian National University (doctors of sciences, professors), other universities of the Republic of Kazakhstan and foreign countries. An author of a paper cannot be its reviewer.

1.4. Duration of reviewing in each case is determined by the Managing Editor aiming at creating conditions for the most rapid publication of the paper.

1.5. Reviewing is confidential. Information about a reviewer is anonymous to the authors and is available only for the Editorial Board and the Control Committee in the Field of Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan (CCFES). The author has the right to read the text of the review.

1.6. If required, the review is sent to the author by e-mail.

1.7. A positive review is not a sufficient basis for publication of the paper.

1.8. If a reviewer overall approves the paper, but has observations, the review is confidentially sent to the author. A revised version of the paper in which the comments of the reviewer are taken into account is sent to the same reviewer for additional reviewing.

1.9. In the case of a negative review the text of the review is confidentially sent to the author.

1.10. If the author sends a well reasoned response to the comments of the reviewer, the paper should be considered by a commission, consisting of three members of the Editorial Board.

1.11. The final decision on publication of the paper is made by the Editorial Board and is recorded in the minutes of the meeting of the Editorial Board.

1.12. After the paper is accepted for publication by the Editorial Board the Managing Editor informs the author about this and about the date of publication.

1.13. Originals reviews are stored in the Editorial Office for three years from the date of publication and are provided on request of the CCFES.

1.14. No fee for reviewing papers will be charged.

2. **Requirements for the content of a review**

2.1. In the title of a review there should be indicated the author(s) and the title of a paper.

2.2. A review should include a qualified analysis of the material of a paper, objective assessment and reasoned recommendations.

2.3. A review should cover the following topics:

- compliance of the paper with the scope of the EMJ;

- compliance of the title of the paper to its content;

- compliance of the paper to the rules of writing papers for the EMJ (abstract, key words and phrases, bibliography etc.);

- a general description and assessment of the content of the paper (subject, focus, actuality of the topic, importance and actuality of the obtained results, possible applications);

- content of the paper (the originality of the material, survey of previously published studies on the topic of the paper, erroneous statements (if any), controversial issues (if any), and so on);

- exposition of the paper (clarity, conciseness, completeness of proofs, completeness of bibliographic references, typographical quality of the text);

- possibility of reducing the volume of the paper, without harming the content and understanding of the presented scientific results;

- description of positive aspects of the paper, as well as of drawbacks, recommendations for corrections and complements to the text.

2.4. The final part of the review should contain an overall opinion of a reviewer on the paper and a clear recommendation on whether the paper can be published in the Eurasian Mathematical Journal, should be sent back to the author for revision or cannot be published.

Web-page

The web-page of the EMJ is www.emj.enu.kz. One can enter the web-page by typing Eurasian Mathematical Journal in any search engine (Google, Yandex, etc.). The archive of the web-page contains all papers published in the EMJ (free access).

Subscription

Subscription index of the EMJ 76090 via KAZPOST.

E-mail

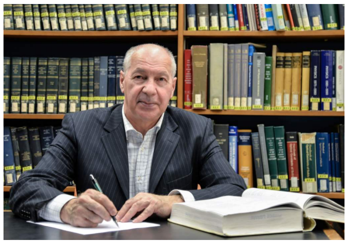
eurasianmj@yandex.kz

The Eurasian Mathematical Journal (EMJ)
The Nur-Sultan Editorial Office
The L.N. Gumilyov Eurasian National University
Building no. 3
Room 306a
Tel.: +7-7172-709500 extension 33312
13 Kazhymukan St
010008 Nur-Sultan, Kazakhstan

The Moscow Editorial Office
The Peoples' Friendship University of Russia
(RUDN University)
Room 562
Tel.: +7-495-9550968
3 Ordzonikidze St
117198 Moscow, Russia

VICTOR IVANOVICH BURENKOV

(to the 80th birthday)



On July 15, 2021 was the 80th birthday of Victor Ivanovich Burenkov, editor-in-chief of the Eurasian Mathematical Journal (together with V.A. Sadovnichy and M. Otelbaev), professor of the S.M. Nikol'skii Institute of Mathematics at the RUDN University (Moscow), chairman of the Dissertation Council at the RUDN University, research fellow (part-time) at the Steklov Institute of Mathematics (Moscow), honorary academician of the National Academy of Sciences of the Republic of Kazakhstan, doctor of physical and mathematical sciences(1983), professor (1986), honorary professor of the L.N. Gumilyov Eurasian National University (Astana, Kazakhstan, 2006), honorary doctor of the Russian-Armenian (Slavonic) University (Yerevan, Armenia, 2007), honorary member of staff of the University of Padua (Italy, 2011), honorary distinguished professor of the Cardiff School of Mathematics (UK,2014), honorary professor of the Aktobe Regional State University (Kazakhstan, 2015).

V.I. Burenkov graduated from the Moscow Institute of Physics and Technology (1963) and completed his postgraduate studies there in 1966 under supervision of the famous Russian mathematician academician S.M. Nikol'skii.He worked at several universities, in particular for more than 10 years at the Moscow Institute of Electronics, Radio-engineering, and Automation, the RUDN University, and the Cardiff University. He also worked at the Moscow Institute of Physics and Technology, the University of Padua, and the L.N. Gumilyov Eurasian National University. Through 2015-2017 he was head of the Department of Mathematical Analysis and Theory of Functions (RUDN University). He was one of the organisers and the first director of the S.M. Nikol'skii Institute of Mathematics at the RUDN University (2016-2017).

He obtained seminal scientific results in several areas of functional analysis and the theory of partial differential and integral equations. Some of his results and methods are named after him: Burenkov's theorem on composition of absolutely continuous functions, Burenkov's theorem on conditional hypoellipticity, Burenkov's method of mollifiers with variable step, Burenkov's method of extending functions, the Burenkov-Lamberti method of transition operators in the problem of spectral stability of differential operators, the Burenkov-Guliyevs conditions for boundedness of operators in Morrey-type spaces. On the whole, the results obtained by V.I. Burenkov have laid the groundwork for new perspective scientific directions in the theory of functions spaces and its applications to partial differential equations, the spectral theory in particular.

More than 30 postgraduate students from more than 10 countries gained candidate of sciences or PhD degrees under his supervision. He has published more than 190 scientific papers. His monograph “Sobolev spaces on domains” became a popular text for both experts in the theory of function spaces and a wide range of mathematicians interested in applying the theory of Sobolev spaces. In 2011 the conference “Operators in Morrey-type Spaces and Applications”, dedicated to his 70th birthday was held at the Ahi Evran University (Kirsehir, Turkey). Proceedings of that conference were published in the EMJ 3-3 and EMJ 4-1.

V.I. Burenkov is still very active in research. Through 2016-2021 he published 20 papers in leading mathematical journals.

The Editorial Board of the Eurasian Mathematical Journal congratulates Victor Ivanovich Burenkov on the occasion of his 80th birthday and wishes him good health and new achievements in science and teaching!

EURASIAN MATHEMATICAL JOURNAL
ISSN 2077-9879
Volume 12, Number 3 (2021), 42 – 45

MAPS PRESERVING THE COINCIDENCE POINTS OF OPERATORS

R. Hosseinzadeh

Communicated by E. Kissin

Key words: preserver problem, coincidence points.

AMS Mathematics Subject Classification: 46J10, 47B48.

Abstract. Let $\mathcal{B}(\mathcal{X})$ be the algebra of all bounded linear operators on a Banach space $\mathcal{X}$ with $\dim \mathcal{X} \geq 2$. In this paper, we describe surjective maps $\phi : \mathcal{B}(\mathcal{X}) \to \mathcal{B}(\mathcal{X})$ preserving the coincidence points of operators, i.e., $C(A, B) = C(\phi(A), \phi(B))$, for every $A, B \in \mathcal{B}(\mathcal{X})$, where $C(A, B)$ denotes the set of all coincidence points of two operators A and B.

DOI: https://doi.org/10.32523/2077-9879-2021-12-3-42-45

1 Introduction

For many years mathematicians have been studying mappings that preserve certain properties. These mappings are generally defined on Banach algebras and are linear or additive and preserve certain properties of operators. In this regard, some researchers omit the assumptions of linearity or additivity and instead consider any preserving conditions of the property of two operators (for example, see [2-8]). In the sequel, we describe the two investigations that are close to our work. Authors in [2] characterize bijections on matrix spaces (operator algebras) preserving full rank (invertibility) of difference of matrix (operator) pairs. Let $\mathcal{B}(\mathcal{X})$ be the algebra of all bounded linear operators on a Banach space $\mathcal{X}$. Let ϕ be a surjective linear map on $\mathcal{B}(\mathcal{X})$ with $\phi(I) = I$. Šemrl in [9] shows that if ϕ preserves injective operators, then ϕ is an automorphism of $\mathcal{B}(\mathcal{X})$.

Let $A, B \in \mathcal{B}(\mathcal{X})$. As it will be stated in Definition 1, $C(A, B)$ is the set of all coincidence points of A and B. It is clear that

$$C(A, B) = \ker(A - B). \tag{1.1}$$

Our main result is as follows:
Main Theorem. *Let $\mathcal{X}$ be a Banach algebra with $\dim \mathcal{X} \geq 2$ and let $\phi : \mathcal{B}(\mathcal{X}) \to \mathcal{B}(\mathcal{X})$ be a surjective map which satisfies*

$$C(A, B) = C(\phi(A), \phi(B)), \tag{1.2}$$

for every $A, B \in \mathcal{B}(\mathcal{X})$. Then $\phi(A) = UA + S$ for every $A \in \mathcal{B}(\mathcal{X})$, where $U = \phi(I) - \phi(0)$ and $S = \phi(0)$.

2 Proofs

First we recall some notation. Denote by $\mathcal{X}^*$ the dual space of $\mathcal{X}$. For every nonzero $x \in \mathcal{X}$ and $f \in \mathcal{X}^*$, the symbol $x \otimes f$ stands for the rank one linear operator on $\mathcal{X}$ defined by the equality $(x \otimes f)y = f(y)x$ for any $y \in \mathcal{X}$. A rank one operator $x \otimes f$ is idempotent (respectively nilpotent) if and only if $f(x) = 1$ (respectively $f(x) = 0$). It is clear that the null space of $x \otimes f$ is $\ker f$ and the image of $x \otimes f$ is $< x >$, the linear space spanned by x.

Recall that $x \in X$ is a fixed point of an operator $T \in B(X)$, if $Tx = x$. Denote by $F(T)$ the set of all fixed points of T. It is easy to check that $F(x \otimes f) =< x >$ if and only if $f(x) = 1$ and $F(x \otimes f) = 0$ if and only if $f(x) \neq 1$. Moreover, it is clear that $F(T) = C(T, I)$.

Definition 1. [1] Let T and S be self-mappings of a set $\mathcal{X}$. If $y = Tx = Sx$, for some $x \in \mathcal{X}$, then x is called a coincidence point of T and S and y is called a point of coincidence of T and S.

Denote by $C(T, S)$ the set of all coincidence points of T and S.

In order to prove the main theorem, we need to some auxiliary lemmas. In the rest of the paper a map $\phi : \mathcal{B}(\mathcal{X}) \to \mathcal{B}(\mathcal{X})$ satisfies condition (1.2).

Lemma 2.1. *For every nonzero vector $x \in \mathcal{X}$ and nonzero functional $f \in \mathcal{X}^*$ there exists a nonzero vector y such that $\phi(x \otimes f) = y \otimes f + \phi(0)$.*

Proof. We have by (1.2)

$$C(x \otimes f, 0) = C(\phi(x \otimes f), \phi(0))$$

and then

$$\ker f = \ker x \otimes f = \ker(\phi(x \otimes f) - \phi(0)).$$

Since $\ker f$ is a hyper space of $\mathcal{X}$, we can conclude that $\phi(x \otimes f) - \phi(0)$ is a rank one operator with null space $\ker f$. Thus, there exists a nonzero vector y such that $\phi(x \otimes f) - \phi(0) = y \otimes f$. ☐

Lemma 2.2. *$\phi(P)P = \phi(I)P$ for every idempotent operator P.*

Proof. We know that an idempotent operator P is equal to the identity operator over its image. So, $F(P) = \mathrm{Im}P$ and then by (1.1)

$$\mathrm{Im}P = \ker(P - I) = C(P, I) = C(\phi(P), \phi(I)) = \ker(\phi(P) - \phi(I).$$

which implies $(\phi(P) - \phi(I))P = 0$. ☐

Lemma 2.3. *$\phi(A) = UA + S$ for every rank one operator A, where $U = \phi(I) - \phi(0)$ and $S = \phi(0)$.*

Proof. Assume that $A = x \otimes f$ for some $x \in \mathcal{X}$ and $f \in \mathcal{X}^*$. We divide the proof into three steps.

Step 1. Assume that $f(x) = 1$. Then $x \otimes f$ is idempotent and so by Lemmas 2.1 and 2.2

$$\phi(x \otimes f)x \otimes f = (y \otimes f + \phi(0))x \otimes f = \phi(I)x \otimes f,$$

which implies

$$(y + \phi(0)x) \otimes f = \phi(I)x \otimes f$$

and so

$$y = (\phi(I) - \phi(0))x.$$

This, together with Lemma 2.1 shows that $\phi(x \otimes f) = Ux \otimes f + S$.

Step 2. Assume that $f(x) = 0$. There exists a linear functional g such that $g(x) = 1$. By Lemma 2.1 and Step 1

$$C(x \otimes f, x \otimes g) = C(\phi(x \otimes f), \phi(x \otimes g))$$

$$= C(y \otimes f + S, Ux \otimes g + S) = C(y \otimes f, Ux \otimes g).$$

Hence,

$$\ker(f - g) = \ker(y \otimes f - Ux \otimes g).$$

This shows that the kernel of operator $y \otimes f - Ux \otimes g$ is a hyper space and so it is a rank one operator. Also the last relation shows that the kernel of operator $y \otimes f - Ux \otimes g$ is equal to $\ker(f-g)$. Thus, there exists a nonzero vector z such that

$$y \otimes f - Ux \otimes g = z \otimes (f-g),$$

which by the equalities $f(x)=0$ and $g(x)=1$ yields $Ux = z$ and then

$$y \otimes f - Ux \otimes g = Ux \otimes (f-g).$$

Hence $y = Ux$ and we obtain by Lemma 2.1 that $\phi(x \otimes f) = Ux \otimes f + S$.

Step 3. Assume that $f(x)=1$ and a is a nonzero scalar. Let h be a linear functional such that $h(x)=0$. By Lemma 2.1 there is a vector y such that $\phi(ax \otimes f) = y \otimes f + S$. This together with Step 2 implies

$$C(ax \otimes f, x \otimes h) = C(\phi(ax \otimes f), \phi(x \otimes h))$$
$$= C(y \otimes f + S, Ux \otimes h + S) = C(y \otimes f, Ux \otimes h).$$

Hence,

$$\ker(af - h) = \ker(y \otimes f - Ux \otimes h).$$

This implies that there exists a nonzero vector z such that

$$y \otimes f - Ux \otimes h = z \otimes (af - h),$$

which yields $y = az$ and then $y = aUx$. Finally, we obtain $\phi(ax \otimes f) = U(ax \otimes f) + S$.

□

Proof of Main Theorem. Let $A \in \mathcal{B}(\mathcal{X})$ and $x \in \mathcal{X}$ be a arbitrary nonzero vector. Assume that $Ax = y = 0$. Hence,

$$x \in \ker A = \ker(\phi(A) - \phi(0))$$

and then

$$\phi(A)x = \phi(0)x = (UA + S)x. \quad (\forall x \in \ker A) \tag{2.1}$$

Now, let $Ax = y \neq 0$ and f be a linear functional such that $f(x) = 1$. Thus,

$$x \in C(A, y \otimes f)$$

and so by Lemma 2.3

$$x \in C(\phi(A), Uy \otimes f + S),$$

which implies that

$$\phi(A)x = (Uy \otimes f + S)x = (UA + S)x \quad (\forall x \in \mathcal{X} - \ker A).$$

This together with (2.1) implies that

$$\phi(A)x = (UA + S)x \quad (\forall x \in \mathcal{X}).$$

Therefore, $\phi(A) = UA + S$. □

Acknowledgments

The author wishes to thank the reviewer for many helpful comments.

References

[1] M. Abbas, G. Jungck, *Common fixed point results for noncommuting mappings without continuity in cone metric spaces.* Journal of Mathematical Analysis and Applications, 341 (2008), 416-420.

[2] H. Havlicek, P. Šemrl, *From geometry to invertibility preservers.* Studia Mathematica, 174 (2006), 99-109.

[3] A. Taghavi, R. Hosseinzadeh, E. Nasrollahi, *A characterization of an isomorphism.* Asian-European Journal of Mathematics, 11 (2018), 1850022, 1-9.

[4] A. Taghavi, R. Hosseinzadeh, H. Rohi, *Additive maps preserving idempotency of products or Jordan products of operators.* Iranian Journal of Mathematical Sciences and Informatics, 11 (2016) 131-137.

[5] A. Taghavi, R. Hosseinzadeh, *Mappings on C^*-algebras preserving the sum of absolute values.* Linear and Multilinear Algebra, 66 (2018), 217-223.

[6] A. Taghavi, R. Hosseinzadeh, *Maps preserving the dimension of fixed points of products of operators.* Linear and Multilinear Algebra, 62 (2014), 1285-1292.

[7] A. Taghavi, R. Hosseinzadeh, H. Rohi, *Maps preserving the fixed points of sum of operators.* Operators and Matrices, 9 (2015), 563-569.

[8] A. Taghavi, R. Hosseinzadeh, V. Darvish *Maps preserving the fixed points of triple Jordan products of operators.* Indagationes Mathematicae, 27 (2016), 850-854.

[9] P. Šemrl, *Two characterizations of automorphisms on $B(X)$.* Studia Mathematica, 105 (1993), 143-148.

Roja Hosseinzadeh
Department of Mathematics
Faculty of Mathematical Sciences
University of Mazandaran
P. O. Box 47416-1468
Babolsar, Iran
E-mails: ro.hosseinzadeh@umz.ac.ir
hosseinzadehroja@gmail.com

Received: 28.04.2020