Приложение
к Заявлению
об участии в конкурсе
на замещение должности
научно-педагогического работника

Сведения
об участнике конкурса
на замещение должности
научно-педагогического работника

ФИО (полностью) ______________ Матвеев Михаил Николаевич ________________________

Должность, доля ставки, специальность____ доцент, 1.0 ст., специальность – математическая логика, дискретная математика и теоретическая информатика _______ (п.2, приказ №1271/1)

Дата объявления конкурса в средствах массовой информации «04» марта 2016 г.

1. Место работы в настоящее время:
   __ Московский физико-технический институт, кафедра высшей математики, доцент __
   (наименование организации, подразделение, должность)
2. Ученая степень (с указанием научной специальности, защита в диссовете при:)
   _____кандидат физико-математических наук, степень присуждена 28.05.2007, защита по специальности 05.13.01 в дис. совете при институте системного анализа РАН _____
3. Ученое звание: ________________________________ не имею ___________________
4. Стаж научно-педагогической работы: _______________ 10 лет ___________________
5. Общее количество опубликованных работ: _____________ 15 _____________________
6. Научные, учебно-методические, творческо-исполнительские работы за последние 3 года:

№ п/п	Наименование работы, ее вид	Форма работы	Выходные данные	Объем в п.л.	Соавторы
1	*2*	*3*	*4*	*5*	*6*
1. Научные труды					
1.	An intermediate value theorem for polytopes (тезисы)	печ.	Abstracts of ICM, Short Communica-tions and Posters, Seoul, 2014, p.129.	1с.	
2.	A simple and accurate method for detecting cube corner rotations (статья)	печ.	Proceedings of the 19th IFAC World Congress, 2014, Cape Town. 24-29 August, pp. 9697-	6с.	

			9702.		
3.	Back faces of a face polytope (статья)	печ.	Lobachevskii Journal of Mathematics, V.36, N.2 (2015) 191-198.	8с.	
4.	Способ определения ориентации объекта с помощью оптико-электронной системы и уголкового отражателя (патент)	печ.	RU 2556282 C1, Бюллетень N. 19 (2015)	12с.	
5.	An intermediate value theorem for face polytopes (статья)	печ.	Lobachevskii Journal of Mathematics, V.37, N.3 (2016) 307-315.	9с.	
2. Учебно-методические труды					

7. Наиболее значимые работы за предшествующие годы (указываются по усмотрению претендента без дублирования с п.6):

№ п/п	Наименование работы, ее вид	Форма работы	Выходные данные	Объем в п.л.	Соавторы
1	*2*	*3*	*4*	*5*	*6*
1. Научные труды					
1.	Невидимые грани и порождающие многогранники (статья)	печ.	Сборник трудов МФТИ, V.3, N.1 (2011) 102-106.	5с.	
2.	Минимальный непорождаемый веер (статья)	печ.	Ученые записки Казанского университета. Серия физико-математические науки. V.154, B.1 (2012) 202-207	6с.	
2. Учебно-методические труды					

Сведения, содержащиеся в п.п. 1-17 настоящего документа, предоставляются участником конкурса в обязательном порядке в соответствии с п.п. 3.1.5.-3.2.4. Положения о порядке замещения должностей научно-педагогических работников СПбГУ, утвержденного приказом Ректора от 27.08.2015 №6281/1, и публикуются на официальном сайте СПбГУ, представляются членам Ученого Совета Факультета (Ученого Совета СПбГУ) по формам согласно Приложению №1 или Приложению №2 в соответствии с п.. 3.4. указанного Положения.

8. Индекс Хирша по Web of Science Core Collection или Scopus ____ / ____
   ResearcherID (при наличии) _________________

В БД Scopus: количество публикаций - 3, количество цитирований - 0, индекс Хирша – неопределён, ScopusID: 55368173100

9. Количество публикаций в базах данных MathSciNet _____ или DBLP _____ за последние пять лет

10. Сведения об участии в научно-исследовательских/творческо-исполнительских проектах, программах, грантах в качестве руководителя

11. Иные сведения о научно-педагогической /творческо-исполнительской деятельности (по усмотрению претендента) __ участник Международных конгрессов математиков (ICM) 2010 года в Хайдарабаде и 2014 года в Сеуле; участник Конгрессов международной федерации автоматического управления (IFAC) 2011 года в Милане и 2014 года в Кейптауне__

Соискатель ____________________ /_ Матвеев Михаил Николаевич _/
(подпись) (Фамилия, Имя, Отчество)

Сведения, содержащиеся в п.п. 1-17 настоящего документа, предоставляются участником конкурса в обязательном порядке в соответствии с п.п. 3.1.5.-3.2.4. Положения о порядке замещения должностей научно-педагогических работников СПбГУ, утвержденного приказом Ректора от 27.08.2015 №6281/1, и публикуются на официальном сайте СПбГУ, представляются членам Ученого Совета Факультета (Ученого Совета СПбГУ) по формам согласно Приложению №1 или Приложению №2 в соответствии с п.. 3.4. указанного Положения.

Mikhail N. Matveev

AN INTERMEDIATE VALUE THEOREM FOR FACE POLYTOPES

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Abstract. A polytope P is called a face polytope if it is considered together with a fan $\mathcal{F}$ such that every cone in $\mathcal{F}$ is spanned by a face of P. The paper proves a theorem that can be treated as an intermediate value theorem for face polytopes. According to this theorem if all fans $\mathcal{F}_\mathcal{S}$ obtained from a fan $\mathcal{F}$ by replacing one of its cones K with a subdivision $\mathcal{S}$ of K in some set H are polytopal, then the fan $\mathcal{F}$ is polytopal as well. Moreover, if $P_\mathcal{S}$, $\mathcal{S} \in H$, are arbitrary face polytopes of the fans $\mathcal{F}_\mathcal{S}$ then some positive combination of $P_\mathcal{S}$, $\mathcal{S} \in H$, is a face polytope of the fan $\mathcal{F}$. The reverse of the theorem is not true.

1. Introduction

A fan is though of as a finite set of pointed polyhedral cones where any two cones meet each other in a proper face of both. The common apex of cones of a fan is assumed to be the origin. We study fans in a relation to polytopes called polytopality. This relation arises when all cones of a fan are spanned by faces of a polytope. The fan itself is called in this case polytopal and the polytope a face polytope. It does matter what faces span cones. We follow [3] and restrict the spanning faces of a face polytope by back faces, which are defined as follows.

Definition 1. *Let P be an n-dimensional polytope in $\mathbb{R}^d$, $0 \leqslant n \leqslant d$, let F be an m-dimensional face of P, $0 \leqslant m \leqslant n$, and let v be any point in $\mathbb{R}^d$. We say that the face F is a back face of the polytope P with respect to the point v if there is a hyperplane H passing though F such that the polytope P without the face F and the point v lie in the same open halfspace determined by H.*

We consider back faces with respect to the origin only, so we omit most of the words and call them simply back faces. One can find that a face of a

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An approximation of fixed points with integer labels

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Abstract: A new method of approximating fixed points of continuous maps is proposed. This method is based on coverings of spaces with a finite number of cones. Because of finite nature of coverings, we obtain an approximation of fixed points with integer labels. Using the proposed approximation in fixed points algorithms leads to robust programming and fast computing.

1. INTRODUCTION

A fixed point of a function f is a point x such that $f(x) = x$. Fixed points appear in many application, especially arising in economic area. In these application fixed points represent equilibria and the existence of fixed points is generally derived from Brouwer's theorem Brouwer [1912].

Brouwer's theorem can be proved constructively via well-known KKM lemma Knaster et al. [1929], but generally this constructive proof is not very fast numerically. The matter is that KKM lemma generates a sequence of simplices from a known simplex to a wanted simplex with given properties.

When applied to Brouwer's theorem this wanted simplex turns out to be an approximation of a fixed point. This is quite perfect theoretically, but following a sequence of simplices numerically slows down any procedure one can imagine to reach an approximation of a fixed point this way.

The situation worsens dramatically as the dimension of the studying problem increases. In spaces of high dimension a simplex can be thought of as a turtle of hundreds legs. Moving one leg, that is, moving one vertex of a simplex, keeps the entire simplex in almost the same place.

As a consequence, in high dimensions an algorithm needs an enormous number of steps just to move yourself from one place to another. Of course, some techniques of com-

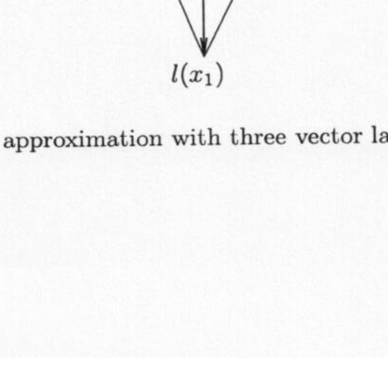

Fig. 1. An approximation with three vector labels.

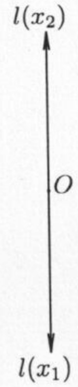

Fig. 2. An approximation with two vector labels.

putation (see van der Laan and Talman [1979, 1981] and also Yang [1999]) diminish occasionally this effect. However the entire problem is still remained basically untouched.

In the following we propose a solution to this problem by introducing a new method of approximating fixed points with integer labels. Comparing the new method with the known one that uses vector labels, we show that approximating with integer labels is much preferable for computing.

2. TYPICAL VECTOR LABELLING

In the case of vector labelling (see Todd [1976]) each vertex x of any simplex receives the label $l(x) = f(x) - x$. A fixed point algorithm finds a wanted simplex whose vertices $x_1, \dots, x_{d+1}$ carry labels $l(x_1), \dots, l(x_{d+1})$ such that the system of equation

$$\sum_{i=1}^{d+1} \alpha_i l(x_i) = 0$$

has a nonnegative solution $\alpha_1^*, \dots, \alpha_{d+1}^* \geqslant 0$.

In other words, a fixed point alorithm finds a simplex with labels $l(x_1), \dots, l(x_{d+1})$ such that zero belongs to the convex hull of $l(x_1), \dots, l(x_{d+1})$ (see Fig. 1). Now suppose that the found simplex is small enough. In view of f is continuous this means that all labels $l(x_1), \dots, l(x_{d+1})$ are almost the same. Hence they are all small enough because otherwise their convex hull would not possess zero.

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A simple and accurate method for detecting cube corner rotations ★

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Abstract: Cube corners are used widely in position detecting devices. A cube corner is attached to an object of interest. Then the position of the object is determined as the distance and two angles of direction to the cube corner. Recent developments make it possible to use a cube corner to detect the orientation of an object as well. However orientation cannot be measured directly, instead it should be recovered from other data. The paper introduces a method of calculating the orientation of a cube corner and shows that the method has an accuracy restricted by the accuracy of direct measurements only. Hence it detects orientation angles of a cube corner up to arc seconds.

Keywords: High accuracy pointing; Guidance, navigation and control of vehicles; Trajectory tracking and path following

1. INTRODUCTION

Cube corners return any light ray hitting them in exactly the opposite direction. This feature makes cube corners used widely in position detecting devices. A cube corner is attached to an object of interest. Then the position of a cube corner is determined as the distance to the cube corner and two angles of direction. Recent developments allow determining not only the position but also the orientation of a cube corner.

Provided a sufficient accuracy, applications of determining orientation are rich and welcome. It suffices to mention measuring hidden objects, controlling manipulations of robots, directing spacecrafts towards docks and so on. One of the problems bounding these applications is that the parameters determining the position of an object are measured directly, while the parameters determining the orientation of an object need to be calculated from other data.

To do this calculation, one should choose a set of parameters (angles) that will describe the orientation of an object, then develop another set of parameters (measured data) that depend on the parameters in the first set and can be measured directly, and finally find a numerical method that will recover the parameters in the first set from the parameters in the second. The method should be simple enough to admit unmanned usage and have a good accuracy.

The paper concerns two approaches to detecting orientation. One approach can be found in Bridges et al. (2010). It is based on viewing an image of the cube corner edges near the apex obtained by the projection alone the optical axis. The other approach is initiated in Matveev (2014). It again uses the projection alone the optical axis but analyzes an image of the entire light flow returned by the cube corner. We present a method of calculating orientation angles developed for the second approach and show that the method is simple, accurate and fast enough.

★ Devoted to Ann.

2. ORIENTATION VIA AN IMAGE OF THE CUBE CORNER EDGES NEAR THE APEX

Bridges et al. (2010) describes the orientation of a cube corner by three angles of rotation about the three axes of a coordinate system defined as in Figure 1. The x axis of the coordinate system is chosen alone the outer normal to the cube corner entrance facet. The three reflecting surfaces of the cube corner meet each other in three lines of intersection. The xy plane is defined as passing though the x axis and one of the intersection lines. The xy plane contains the y axis, which is perpendicular to the x axis. The z axis is perpendicular to both x and y axes.

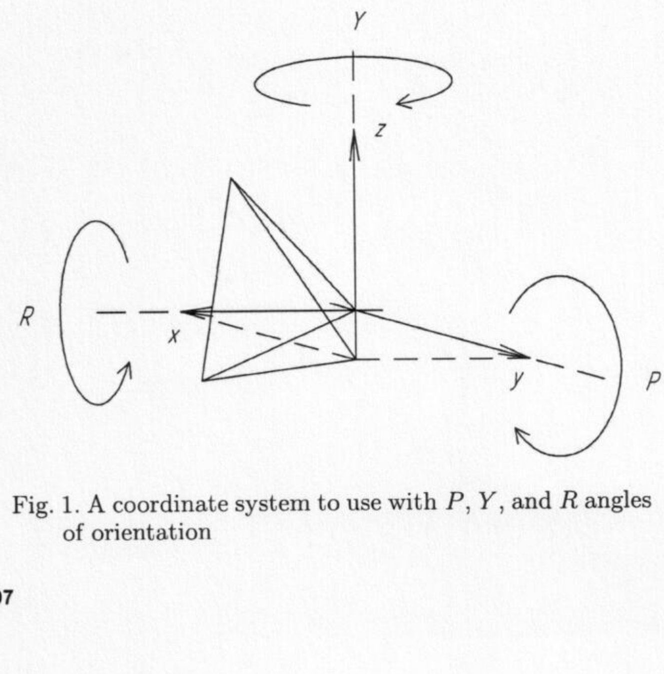

Fig. 1. A coordinate system to use with P, Y, and R angles of orientation