About Typical Errors in Representing Big Data and Digital Twins Made when Using Methods Mathematical Modeling

Gulnara Lutfullina[1] and Rafail Tukshaitov[2]
Kazan State Power Engineering University Kazan, Russia
trh_08@mail.ru, gflutfullina@mail.ru

Key words: modeling, data presentation error, methodology error in, overestimation of accuracy, mechanism of error formation.

Abstract: The work examines typical errors in the representation of big data and digital twins, which are made during their mathematical modeling, the structure of the error of mathematical modeling techniques and the mechanism of its formation. Recommendations are given for the presentation of large experimental data based on taking into account the errors of the initial indicators and modeling techniques. Calculating the error in representing big data as a percentage allows the author to quickly identify that it is often, when modeling processes, 1000 and even 100,000 times less than the error of the research methodology. The accuracy of data presentation in some cases can even be an order of magnitude greater than the accuracy of precision instruments used. The error of the modeling results is to a large extent determined by the error of the initial data used for calculations and modeling. A more significant component in the structure of the total error of the research methodology is the error in constructing the mathematical model of big data and digital twins itself, the value of which can range from ±10 to ±50%. Based on the actual permissible error of the measurement technique, recommendations are given on the degree of rounding of experimental data. The inadmissibility of direct readings from the screen of a personal computer is noted. For clarity, a number of examples of big data are provided, borrowed from the literature, in their original published form and after rounding them in accordance with the given recommendations. Keywords: mathematical modeling, error in the representation of big data, error in the modeling methodology, the mechanism of formation of the total error.

1 INTRODUCTION

I would like to begin this paper with the statement made more than 50 years ago by the Irish physicist H. Schenk (Schenk, 1972). I wish to eliminate the reader's doubts regarding the degree of relevance of the issue under consideration: "In many laboratories ... they often conduct experiments with instruments which have a wide range of accuracy... The study of resulting error makes it possible to predict errors for the system as a whole,… it makes possible to detect weaknesses in the performed measurements." One should agree with the author of this statement only on one important issue. At the same time it is necessary to make certain clarifications regarding the share of instrument error in the total error of the big data measurement technique. The material is based on the results we have revealed over decades at Forums at various levels. Most authors in various fields of knowledge think (Schenk, 1972) that the experiment error is determined by the error of the instruments used. This approach is wrong, because during the experiment setup and its implementation, additional errors must be taken into account. Previously, it was repeatedly explained that the total error of an real experiment is determined not so much by the error of the instruments used, but by the error of the experimental technique can differ significantly. This is due to the fact that the total error in the methodology of studying big data usually consists of a number of other methodological errors (Tukshaitov, 2006; Tukshaitov, 2019).

Some issues of optimal presentation of research results, including the presentation of mathematical

[1] https://orcid.org/0009-0004-1936-2658
[2] https://orcid.org/0000-0003-1572-5314

modeling results, are presented in a few sources (Krylov, 1954; Shchigolev, 1962; Seidel, 1985) that are inaccessible but remain little known to readers. This leads to the fact that many numerical data of the results, especially results of mathematical modeling of digital given by the authors are overestimated in the accuracy by as much as 3-5 orders of magnitude. For example, results described by two-digit numbers are given by six-digit and seven-digit numbers even within the same publication. It takes place in some works (Zubov, Mikrin, Ryabchenko, Poklad, 2016; Sybov, 2018; Zhukova, Morozov, 2023; Tukshaitov, 2021).

There are four sources of error in the result.

The error of the mathematical model. If the mathematical model is not chosen carefully enough, then no matter what methods we use for the calculation, all the results will not be reliable enough, and in some cases, completely incorrect.

The error of the initial data accepted for calculation. This is an unavoidable error, but this error is possible and must be assessed to select a calculation algorithm and the accuracy of the calculations.

The method error is based on the discrete nature of any numerical algorithm.

The rounding error is associated with the use in computers of numbers with finite representation accuracy.

Modeling results represented in the literature are highly overestimated in accuracy. This problem prompted us to introduce into practice, along with the term “measurement error,” a new term “representation error” (Tukshaitov, 2006; Tukshaitov, 2021).

What is a typical error in presenting mathematical modeling data?

The authors give significant figures in numbers arbitrarily, relying on the rounding level that is inherent in a given computer. Because of this, there are quite a lot of works where data in tables is given (Sybov, 2018; Elkina, 2005) from four-digit numbers to six (Zubov, Mikrin, Ryabchenko, Poklad, 2016; Elkina, 2005) - and eight-digit (Sybov, 2018). The accuracy of the results should be based on the accuracy of determining the initial indicators of the object included in the mathematical model. Some initial indicators of the sample parameters can be two-digit, others - three-digit, and others four-digit, respectively, with an error of at least 1%, 0.1% and 0.001%. At the same time, the number of significant figures as a result of the calculation should be no more than two. The degree of influence of each indicator on the final result of the calculation should be taken into account. Let us give a number of examples of misunderstanding of the importance of correct presentation of experimental data, identified only in recent years.

2 STATEMENT OF THE BACKGROUND OF THE PROBLEM

By 2002, having already had sufficient experience in processing experimental results presented in a number of publications, we made a report at the Kazan Institute of Physics and Technology named after Zavoisky at a school-seminar organized for physicists of the Middle Volga region. The seminar was then led by the vice-rector of science of Kazan State University (currently Kazan Federal University - KFU), and subsequently by the rector of KFU and the President of the Academy of Sciences of the Republic of Tatarstan M.Kh. Salakhov. To our surprise, the participants did not ask us a single question. Summing up the report, the head of the scientific seminar expressed the following thought: “Colleagues, over the past 25 years we have fallen behind in the processing and presenting experimental data.”

In 2010, we gave a special report to the staff of the Institute of Biophysics and Biochemistry of the Kazan Branch of the Academy of Sciences on the topic “Optimal methods for processing and for presenting experimental data.” The seminar participants listened to the report with approval and noted that they had read something at the university, but unfortunately much had already been forgotten.

Around 2017, at Annual Scientific Conference of the Institute of Energy of the Kazan Center of the Russian Academy of Sciences some speakers were told that the numerical data of mathematical modeling presented by them were overestimated by 3-4 orders of magnitude and their director Professor V.N. Shlyannikov generally agreed with that.

In 2020 we made a scientific report at Republican scientific seminar “Methods of mathematical modeling”, held under the auspices of the Academy of Sciences of the Republic of Tatarstan, dedicated to the same issue. The video of the speech was immediately posted on the Internet on the website of the scientific seminar. During the first year alone, more than 1,600 people read the report. Several well-known scientists of Kazan highly appreciated our understanding of the problem and the work done, for example, such as the head of the Department of

General Physics of KFU, long-term dean of the Faculty of Physics A.V. Aganov; Head of the Department of General Physics, Kazan National Research Technical University - Kazan Aviation Institute (KAI), Professor, Academician of the Academy of Sciences of the Republic of Tatarstan B.A. Timerkaev; Director of the Institute of Mathematics of the Kazan Federal University, Professor, Academician of the Academy of Sciences of the Republic of Tatarstan Nasyrov S.R. and others. At the same time during the meeting Professor B.A. Timerkaev stated that practically many results containing more than three significant figures are obtained with such precision. We fully share this perception of his presentation of the results.

A year later we took part in the same seminar on “Methods of Mathematical Modeling”. One of Kazan National Research Technical University professors, the theoretical physicist who had previously participated in many foreign forums in Europe, Israel, Turkey, China and Japan, gave a presentation. His results were given in five-digit numbers. With friendly irony, he was asked the question: “Maybe your results will be more accurate if they are presented not in five-, but in six-digit numbers.” The speaker did not begin to polemicize and briefly answered that everything was accurate. True, he later made it clear and said that these were not his data. The data were borrowed from another paper. We replied that it was necessary to borrow numerical data with their preliminary appropriate rounding. His colleague, the recognized scientist at Kazan National Research Technical University, came to the speaker’s defense. He began to explain that the numerical data in the work were presented correctly because an analog-to-digital converter with very high accuracy was used. Such a stereotypical view unfortunately is often among many researchers who have a lot of experience in scientific work.

In the fall of 2023 during International Scientific Conference dedicated to the 100th anniversary of Rashid Shakirovich Nigmatullin the former rector of the Kazan Aviation Institute and the radiophysicist, one of the speakers (El-Khazali, 2023), representing the University in Abu Dhabi of the United Arab Emirates, *EL-Khazari Reayrd* was asked the following question regarding the accuracy of his mathematical modeling results: “Your table presents the results of mathematical modeling in five-digit numbers. Data are often presented with such accuracy in our prestigious physics journals. Your data is actually determined with an error of up to 0.0001%. Please tell me what the error was used in the research methodology, which we should focus on.” This question puzzled the speaker and he replied: “The error was determined by the error of the mathematical method.” Further, continuing the debate, they added that “each mathematical method had its own certain error.” The chairman of the meeting suspended our discussion because the speaker was a foreign guest. According to our assessment, the accuracy of data presentation in his work is overestimated by 1000-10000 times relative to the accuracy of the methodology used. With our question, we only wanted to draw the attention of the speaker and of the audience to the inadmissibility of unconfirmed accuracy of calculation results. At this conference, during a break, we briefly met Professor Nikitov S.A., one of the interesting speakers at the Plenary session, who gave me his email address to forward one of our articles.

Somewhat later, with the help of the Internet, it turned out that he was the director of the Institute of Radio Engineering and Electronics and the academician of Russian Academy of Sciences. To explain this problem, we sent him one article (Zhukova, Morozov, 2023). Some time later we sent him another article of a sociological nature (2022), where we proposed our method of determining the rating of scientists which may be of interest to him. Unfortunately, no replies were received. Partly due to his busy schedule and to the fact that these issues seemed not relevant to him, especially in relation to solving problems in radio engineering and electronics. We can only partly agree with this because there are analysis of a number of explanatory examples presented in journals, including “Practical Power Electronics” (Tukshaitov, 2021). I would like to especially note the attitude of the Academician of the Russian Academy of Sciences, the former director of the Military Academy of Shipbuilding, the professor of mechanics and mathematics A.N. Krylov and the author of a series of lectures on approximate calculations (Krylov, 1954) to this problem. He often, as a director, even punished his employees for overestimating the accuracy of calculated data, because the permitted overestimation of data increased demands on the results of calculations of subsequent indicators.

At the end of the scientific conference, the discussion on our remark continued in correspondence with one of the authoritative physicists, who concluded by noting that “the accuracy of the representation did not play a serious role when writing the final result”. None of the readers analyze errors in arithmetic operations. This kind of 'enlightenment' has no meaning for the audience." Misunderstanding of the relevance of this problem puzzled and prompted us to once again take up the task of clarifying the issue, especially since my respected opponent recommended "writing a new article and showing when errors become significant."

Based on the above-mentioned nature of the reaction to our statements regarding mistakes made in presenting experimental data and modeling results, one can judge the insufficient perception of the issues covered by a fairly wide range of researchers.

Numerical explanation of the errors formation mechanim

According to an important provision of metrology, the error in data presentation should not be higher than the error in the measurement technique, since an overestimated representation of the accuracy of the data is often mistakenly perceived as the high accuracy of the research. A typical mistake made by researchers is that in numerical modeling the data is assumed to be fixed without taking into account the error in determining the initial data themselves, which in this case should be perceived as physical "constants". According to (Seidel, 1985), even physical constants undergo changes over time due to changes in the initial conditions of their determination. For a clear explanation, here are a few elementary examples.

Some authors believe that if only one of the parameters is represented by a three-digit number, then the result of the calculation should also be represented as a three-digit number. The latter, for fear of loss of accuracy the result of the calculation is given as a four-digit number, for example in the form of 3.245, while it is enough to give the result of the calculation only as a two-digit number (in the form of 3.2).

This explanation still remains insufficiently clear to many scientists, and therefore we will explain it in a different way. Suppose in the numerator of the analytical expression the first number is represented by a two-digit number, the second by a three-digit number, and in the denominator by a four-digit number, or in other words, they are presented respectively with an error of 5%, 0.1% and 0.01%. If the error in presenting the result must correspond to the error in the measurement technique (Tukshaitov, 2006), then the calculation result cannot be presented with an error of less than 5%. It follows that the result of the calculation, depending on the absolute value of the number in this example, can be represented as a two-digit number.

To illustrate the overestimation of modeling results allowed in publications, we present a table borrowed from (Tukshaitov, 2021).

Table 1: Power modeling results of control cascade in the Multisim software environment (Tukshaitov, 2021).

Parameters	Uin min and in = 50 A	For For Uin nom and in = 50 A
Input supply voltage (V14)	13.59842	16.99842
Output voltage (V15)	11.99809	12.00001
Emitter voltage VT14 (VT16)	13.43185	13.43384
Voltage on base VT5	3.23106	13.23301
Emitter voltage VT (V22)	2.21896	12.22092

In this table the parameters of the power transistor, usually measured by modern devices with an error of 1-2%, are erroneously shown in seven-digit numbers with an error in their representation of at least 0.00004%.

Perhaps the above explanation of the issue continues to remain not entirely clear to the reader. Therefore, we will explain the mechanism of formation of the error in the result using the following specific examples of numerical modeling.

Example. Let's demonstrate the permissible error using a simple example. Let's say we need to calculate the value of Y based on only three known parameters using the formula Y = (A B)/C. Substituting their conditional values into the formula, we get

$$Y = (13 \bullet 373)/\ 22.16=218.82$$

The first number is actually an integer with a margin of error of 3.8%. The second number is with a margin of error of 0.14%. The third number is with an even smaller margin of error of 0.023%. Without taking into account possible deviations of the parameters from the original ones, most authors will give a similar result equal to 218.8. The smaller of them is equal to 218.82 and even 218.824, and practically few - as an integer with additional rounding in the form of 220. Since the actual calculation error is 3.8 %, then the desired value, depending on the level of the greatest error of the entered number, will be reproduced in the range 211 - 228. Based on this, the result of the calculation can be completely written as the number 219, or better yet 220.

If we take into account the probability of an overestimation of two factors only in the numerator, and let's say the denominator remains unchanged. Then we get another number equal to 219, which naturally fits into the above range of probable values. As the number of factors in the numerator and denominator of the formula increases, the error in determining the result by numerical modeling will only increase. It follows that tenths and hundredths are misrepresented in the calculation and they should therefore be excluded. It is necessary to additionally round whole numbers, giving only the first three significant digits as digits, and the rest as significant zeros.

These recommendations for presenting results are based on taking into account only the error of the initial parameters included in the model. At the same time, specialists in mathematical modeling know that the deviation of modeling results for a number of reasons can actually range from 10 to 50% due to the inadequacy of the model itself. Based on these error levels, we can conclude that the simulation results are often only fair to present as a two-digit number.

The scientific community doesn't accept the need to eliminate errors in processing experimental and calculating data. We have to give a number of more examples in different areas of knowledge in our article. It should be noted that all numbers given in (Kostinsky, 2020) are five- and six-digit, which is as much as 2-3 orders of magnitude higher than the accuracy of the instrument used, which is not acceptable. Conversion frequencies also could not be established experimentally with such high accuracy (0.001%). We propose to consider the same table, but edited in accordance with metrological requirements.

Table 2: Table borrowed from (Kostinsky, 2020).

f, Гц	Converter loading range, %	Interval of changes in THDi values, %		Relative change in THDi, %
		min	*max*	
50	19.947 – 65.038	143.958	106.493	35.231
45	17.611 – 54.318	147.218	112.643	30.703
40	15.120 – 44.359	150.478	119.242	26.290
35	12.951 – 35.593	155.381	121.964	27.397
30	11.145 – 27.781	163.041	131.412	24.132
25	9.487 – 21.040	162.121	140.906	15.031

Table 3: Form of presentation of the table (Kostinsky, 2020) in accordance with metrological requirements.

f, Гц	Converter loading range, %	Interval of changes in THDi values, %		Relative change in THDi, %
		min	*max*	
50	19.9 – 65.0	144	106	35
45	17.6 – 54.3	147	113	31
40	15.1 – 44.3	150	119	26
35	12.9 – 35.5	155,	122	27
30	11.1 – 27.7	163	131	24
25	9.48 – 21.04	162	141	15

The relative values of THDi, expressed as a percentage, can easily be presented as two-digit numbers for the reason that, on the one hand, the accuracy of their representation is overestimated, and on the other hand, this indicator is the final indicator in our research. It is not intended for calculating derivatives indicators. Therefore, it can be represented with slightly less accuracy. Based on the accuracy of the data presented in table 2 we can say that contrary to the authors' statement, the data were obtained not experimentally, but by calculation.

The accuracy of the representation of g-factors when presenting the results of research in the field of Electron Paramagnetic Resonance is not adequate. It remains unclear how some authors give the g-factor as single-digit numbers (Dubiel, Zywczak, Mariarze, 2019; Domracheva, Vorobyova, 2017; Piwowarska, Grutek, Rudowicz, 2019), and others as five-digit (Altshuler, S., 1972; Shakurov, 2019;Tampieri, Tommassini, Agnoli, 2020) and even seven-digit numbers in the form 2.002757±0.000006 (Wertz, Boldton, 1975). In the latter case, along with the g-factor value, the standard deviation is given, which, as a rule, is not indicated by many authors. In addition, in this work, the accuracy of number representation is an order of magnitude which is higher than the accuracy of the relative value of the standard deviation. If we take into account the capabilities of computer technology, then the question arises why many were limited to seven-digit numbers.

In (Chachkov, Mikhailov, 2017), the molecular structures of 14 forms of the Al2Zn3 metal cluster were calculated. At the same time, the authors make a reservation about the approximate nature of the calculations. In table 4 the coordinates of atoms in molecular structures for only two forms are given.

Table 4: Coordinates of metal atoms in molecula (Tampieri, Tommassini, Agnoli, 2020).

Atom	Cartesian coordinates		
	x	y	z
Form 1			
AL1	-0.385668	0.000571	-1.387377
Al2	-0.386316	-0.000851	1.385837
Zn1	1.539499	1.239631	0.000574
Zn2	1.540108	-1.239388	-0.000115
Zn3	-2.745080	-0.000122	0.000209
Form 2			
AL1	0.620927	0.004761	0.550702
Al2	-0.897038	-0.000653	-1.871691
Zn1	-1.602745	1.289997	0.281809
Zn2	-1.596045	1.292645	0.282526
Zn3	3.318438	0.000868	0.008094

Using approximate calculations, the authors present results with an error of 0.00003%. Naturally, no device or technique used will provide such high accuracy. This means that the work contains a significant overestimation of the accuracy of data presentation.

We should also dwell on one typical error, which consists in overestimating the readings of the instruments themselves by 3 or even 10 orders of magnitude (Batalov, Novikov, Faizullin, Kurbatov, Gerasimov, 2023; Savinykh, Garkushin, Ruzorenov, 2023). Thus, when studying the Romanov spectrum of sapphire, the authors give the peak positions in four-digit numbers, with an error of the order of 0.007%. Modern instruments are not capable of measuring the absolute values of the parameter under study. We can only talk about relative shifts of a parameter measured on the same instrument. The accuracy of the instrument readings should be based on the absolute error of the instrument, and not on the digital display data of the instruments, which always provides more accurate readings (several orders of magnitude).

We hope that a careful reading of the content of this work will allow the authors to avoid a number of common mistakes in presenting their data and take a more critical approach to analyzing the reliability of the materials of other researchers.

3 CONCLUSION

1. The error of modern instruments can often constitute only a small fraction of the total error of the mathematical modeling technique. Based on this, when assessing the results of mathematical modeling and numerical calculations of big data and digital twins, one should be guided only by the total methodological error.

2. The modeling error and, accordingly, the level of rounding of its result should be determined based on the error in determining the initial parameters used.

3. The number of significant digits produced by the computer on the display screens and instruments is determined only by their software settings. Therefore, numbers from four to twelve digits displayed on the monitor screen are subject to subsequent rounding, based on the real error of the final result of mathematical modeling.

4. To increase the productivity of processing big data and digital twins in the future, it is necessary to develop and use a tunable program that would allow the researcher to display results on a computer screen, taking into account the methodological error in determining each initial parameter and the methodological error of the mathematical model itself.

REFERENCES

Schenk, K., 1972. Theory of engineering experimen. Moscow: Mir.

Tukshaitov, R., 2006. Fundamentals of optimal presentation of statistical indicators in graphs, diagrams and tables (physics, chemistry, technology, biology and medicine). Ministry of Education and Science of the Russian Federation, Kazan State Energy University, Kazan.

Tukshaitov, R., 2019. System analysis of typical errors made in catalogs of LED lighting devices.To eliminate the fifth typical error," Semiconductor lighting engineering, No. 5 (61), pp. 16-20.

Krylov, A., 1954. Lectures on Approximate Computing. 6th edition. State Technical Publishing House, Collected works, vol. 3, part 1, Publication of the USSR Academy of Sciences.

Shchigolev, B., 1962. Mathematical processing of observations. Moscow: State Publishing House of Physical and Mathematical Literature.

Seidel, A., 1985. Errors in measurements of physical quantities. Edited by Academician Zh.I. Alferova. Leningrad: Nauka.

Zubov, N.E., Mikrin, E.A., Ryabchenko, V.N., Poklad, M.N., 2016. Parameterization of analytical laws for controlling the lateral movement of aircraft. *Bulletin of MSTU im. N.E. Bauman. Series: Instrumentation,* No. 2, pp. 3-17.

Sybov, N.N., 2018. Modeling processes in electrical circuits in problems of intelligent learning systems. *Practical power electronics,* No. 4 (72). pp. 47-56.

Zhukova, D., Morozov, M., 2023. The use of carbon-felt frames as an electrode conductive base for supercapacitors". International scientific conference "Nigmatullin readings – 2023," Collection of reports, October 9 - 12, 2023, Kazan ed. AN RT, pp. 292-295.

Tukshaitov, R., 2021. To eliminate typical errors in the presentation of electrical data allowed in textbooks and scientific periodicals. *Practical power electronics,* No. 1 (81), pp. 50-55.

Elkina, T., 2005. Power supply for industrial enterprises and civil buildings. Laboratory workshop: Textbook. Minsk: UE "Technoprint", pp. 64-71.

El-Khazali, 2023. "Reyad discretization of fractional –order controllers of complex orders," in Proceedings of the International Conference "Nigmatullin,s Readings-2023," Kazan: TAS publishing house, p. 14,

Kostinsky, S., 2020. Review and results of studies of the harmonic composition of the current consumed by low-power frequency converters, as well as methods and devices to reduce their negative impact on power supply systems. News of higher educational institutions. *Energy problems*, vol.. 22, No. 2, pp. 27-42.

Dubiel, K., Zywczak, A., Mariarze, W., 2019. Magnetic phase trasition and exchange bias in Ni45 Co5 Mn35.5 In14.5," Applied Magnetic Resonance, Vol. 50, pp. 809-818.

Domracheva, N.E., Vorobyova, V.E., 2017. Influence of anions on spin-crossover properties, molecular packing and magnetic behavior of dentritomer complexes of Fe (III) of the second generation," in. KIPT im. E.K. Zavoisky 2017. Yearbook, vol. 50, No. 6, pp. 63-70.

Piwowarska, D., Grutek, P., Rudowicz, C., 2019. Origin of ground Kramers Douplets for Co2+(3D17) ions with the effective spin 3/ verbus the fictitions spin1/2. Applied Magnetic Resonance, vol.. 50, pp. 797-808.

Altshuler, S., 1972. B. Kozyrev, Electron paramagnetic resonance of compounds of intermediate groups. M.: Nauka, pp. 265-271.

Shakurov, G.,2019. Tetrahedral centers of Cr4+ ions in a Li2CaSiO4 crystal. in KIPT im. E.K. Zavoisky, Yearbook, 2020, pp. 71-78.

Tampieri, F., Tommassini, M., Agnoli, S., 2020. N-Doped Graphene oxide nanoparticles studied by EPR. Applied Magnetic Resonance, vol. 47, pp. 1481-1489.

Wertz, J., Boldton, J., 1975. Theory and practical proposals of the EPR method. Transl. from English M.: Mir, pp. 367-369.

Chachkov, D.V., Mikhailov, O.V., 2017. Molecular structures of polynuclear metal clusters according to calculations using the DPT method. XVL (heterobi) pentanuclear cluster Al2Zn3,"Bulletin of the Technological University, vol. 20, No. 16, pp. 5-8.

Batalov, R., Novikov, G., Faizullin, D., Kurbatov, N., Gerasimov, K., 2023. Pulsed ion annealing of sapphire single crystals implanted with chromium ions," in KIPT im. E.K. Zavoisky, Yearbook vol. 22, pp. 111-117.

Savinykh, A., Garkushin, G., Ruzorenov, S., 2023. The influence of temperature on the dynamic elastic limit and spall strength of a lead-bismuth alloy at a shock compression pressure of up to 2.4 GPa. *Journal of Technical Physics,* vol. 93, issue 3, pp. 380-386.