

# Ivo and Renata Babuška

a personal story by

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## Ivo and Renata



# Ivo Milan Babuška

- March 22, 1926** Born in Prague, Czechoslovakia, son of architect Milan and Marie Babuška, had a younger brother (a physician) Milan R. Babuška
- March 15, 1939** Germany invades and occupies Czechoslovakia. Ivo studies at a vocational school but has a university professor math tutor.
- 1949 and 1951** Dipl. Ing. in Civil Engineering and Dr. Tech (Ph.D.) in Civil Engineering from the Czech Technical University in Prague.
- 1953** Ivo meets Renata. They marry four years later.
- 1955 and 1960** C. Sc (Ph.D.) and Dr.Sc. (habilitation) from the Mathematical Institute of the Czechoslovak Academy of Sciences.
- 1955-1968** Ivo heads Dept. for Constructive Methods of Math. Analysis in the Czech Academy of Sciences and oversees the Orlik dam project.
- August 1968** Soviets invade Czechoslovakia. Ivo and Renata with children: Lenka and Vit manage to leave Prague for Maryland, USA.

1937



Visiting Prague ZOO with parents and brother

## Ivo Milan Babuška - cont.

- 1968 Ivo and Renata decide to stay permanently in United States. The Czech regime considers Ivo and Renata criminals and sentences them to prison *in absentia*.
- 1970 Ivo co-founds the Finite Element Circus.
- 1995 Ivo retires as a Distinguished Professor Emeritus from Maryland and moves to Texas. He initiates the Texas branch of FE Circus, later renamed as a FE Rodeo.
- 2005 Elected to National Academy of Engineering.
- 2012 Receives the Lerroy P. Steele Prize for Lifetime Achievements;
- 2018 Retires from University of Texas.
- April 2, 2020 Renata dies. In August 2020 Ivo moves to an assisted living facility in Albuquerque, NM.
- April 12, 2023 Ivo dies in Albuquerque, NM.

## Ivo's contributions (courtesy of Doug Arnold)



- mathematical foundations of FEM
- inf-sup condition
- Lagrange multiplier method
- FEM with penalization
- mesh-dependent norms
- generalized finite element methods
- countably normed spaces
- partition of unity methods, meshless methods
- approximation theory of piecewise polynomial spaces
- p-version of FEM
- Babuska paradox
- a posteriori error estimation
- dimensional reduction
- hierarchical modeling
- optimal meshes
- homogenization
- corners and singular functions
- uncertainty quantification
- n-widths
- hp-version of FEM
- adaptive FEM
- the angle condition
- FEM for eigenvalue problems
- high frequency Helmholtz eq
- pollution in FEM
- rough coefficient problems
- locking and robustness
- optimal interpolation points in 2D
- approximation of stochastic PDE

## Memories of Ivo

I met Prof. Babuska for the first time at TICOM in late eighties and we became instant friends. He visited with me in Poland in 1991 and 1993. Prof. Oden and I were very happy when he accepted our invitation to join TICAM and came to Texas in 1995. Since then, along with Dr. Oden, he became my scientific mentor and increasingly more and more a close personal friend.

Ivo had a unique curiosity in him that made him very open to new ideas. He was always at a forefront of new topics. In fact, he is credited with over thirty new subjects (if not fields) that he had initiated. His office was always open and he always had time for discussions on different subjects, even those that were not even in vicinity of his interest and/or expertise. On MANY occasions, I would enter his office and asked 'Ivo, do you have a few minutes for a short question?' (Those minutes, most of time would evolve into hours). He would sigh - 'Leszek's minutes' and he would ALWAYS invite me in. Over the years, I learned to run my new mathematical ideas first through him. Even when the subject was outside of his expertise, his incredible insight and intuition in mathematics would help me a lot.

Ivo never wrote a single line of code but had a superb understanding and intuition for numerical results. On many occasions I would show him some results and he would point to inconsistencies with mathematics and possible errors in understanding or bugs in the code.

## Memories of Ivo

**He loved to argue on whatever the subject.** We had many heated political discussions (he was rather liberal, I am very conservative) but we also discussed a lot religion and history. With time, I learned that the exercise of discussing things was more important to him that the actual opinion. He would literally switch sides to have a good discussion on whatever subject. Renata and Ivo would start every day at 5am by reading New York Times and other newspapers. He was literally upset when I lacked information about current political events. In a particular way, hew would 'attack' me on any 'hot' issues related to Poland or/and Catholic Church.

**He was always interested in my family.** From time to time, Stasia and I would invite him and Renata to our house and it was always fun to have them.

**Renata and Ivo had season tickets for philharmony** and, when they could not make it, Stasia and I had to go. It was never 'for free', I had to give a precise account on was played and who performed. At age 82, he stopped going overseas and delegated several invitations to me. I had always to report on what I had learned and who participated in the meeting.

## Memories of Ivo

Our daily lunches with Ivo, Tinsley and several faculty and students, became eventually the high point of Ivo's daily activities. Even when he was not feeling very well, he would try to arrive in office in time to go for lunch. He advocated 'beating the crowd' and enforced going for lunch at 11:30. In time, he developed a 'Pavlov dog reaction' in me, I am getting very hungry at 11:30.

He would never say no to an invitation for dinner with a seminar speaker. As he aged, I tried to have dinners in a German restaurant next to his house, so I could pick him up and take with us for the dinner. He enjoyed it very much and was always an attraction for the speakers.

I have had the honor to organize celebrations for his 80, 90 and 95th birthday. I visited him in Albuquerque (with Stefan Henneking and Jacob Badger) for his 96th and, a couple of weeks before he died, for his 97th birthday. I promised to organize his 100th birthday... He did not make it.

## Memories of Ivo

I was with him with in the difficult week during Covid time when Renata was dying. He made me read a number of papers on Machine Learning, run experiments and discuss them with him for a couple of hours on phone every day. He was very grateful for this as, in his own words, he was going crazy seeing Renata passing away... After he moved to Albuquerque, we would call each other every 3-4 days. He complained a lot that he was unable to do mathematics anymore.

I am missing him a lot, as a very close friend, teacher and colleague. I hope, he will always be remembered at Oden Institute even by those who have never met him.

The following is the story in pictures...

# Outline

1 1960s

2 1970s and 1980s

3 1990s

4 2000s

5 2010s

# 60s: Ivo's conference in Prague



One of very rare meetings attended by mathematicians from East and West

# Outline

1 1960s

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## 70s: friends



With Max Gunzburger, J. Tinsley Oden, Franco Brezzi, Tom Hughes, Ken Morgan, Earl Thornton



Young Ivo Babuška



Ivo again

# Outline

- 1 1960s
- 2 1970s and 1980s
- 3 1990s**
- 4 2000s
- 5 2010s

## 1997: celebrating Tinsley's 60th



Renata with Stasia and Lee

## 90s: with Tinsley, Leszek, Stasia, Mark and Fanis



# Outline

1 1960s

2 1970s and 1980s

3 1990s

**4 2000s**

5 2010s

## 2000s: ICES bluebonnet parties



Leaving the party



with Tinsley, Barna Szabo



with Mary

## 2000s: more parties



with Tinsley



with Stasia



## 2000s: more parties



In our home around 2005

# 2003: Leszek's 50th birthday



# Outline

- 1 1960s
- 2 1970s and 1980s
- 3 1990s
- 4 2000s
- 5 2010s**

## 2010s: in the office



## 2012: UT tower lighting for Ivo



## 2014: Mike and Carmen visiting



## 2010s: ICES seminars



after an ICES seminar



dinner with a seminar speaker

# 2010s: bluebonnet parties



with Tinsley



with Graham



## 2016: celebrating Ivo's 90th



## 2016: celebrating Tinsley's 80th



## 2016: celebrating Tinsley's 80th



## 2010s: ICES activities



Christmas 2016



Christmas 2018



Christmas 2015

## 2010s: presidential award



UT 2018: celebrating Presidential Award for Tinsley, Ivo and Luis Cafarelli

## 2018: Ivo retiring



with Renata



with Leszek

## 2020s: celebrating Ivo's 95th



Albuquerque, Sep. 2021



## 2020s: last visit: celebrating Ivo's 97th



Albuquerque, Mar. 22., 2023



## 2020s: last visit: celebrating Ivo's 97th



Albuquerque, Mar. 22., 2023



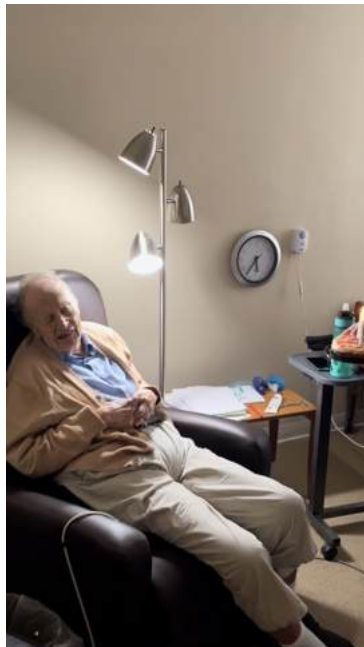
## 2020s: last visit: celebrating Ivo's 97th



Albuquerque, Mar. 22., 2023



## March 22, 2023: Ivo's 97th birthday



## April 2023 - Ivo's birthday wishes for me



Recorded a few days before Ivo passed away

I have had a unique life chance and a privilege  
to work alongside a giant like Prof. Ivo Babuška  
I will forever treasure memories of him.

Thank you for your attention!