

A Personal Digital Library of Electrical Machines



Relu ILIE

Iris Rotating Machine Conference

June 28, 2023

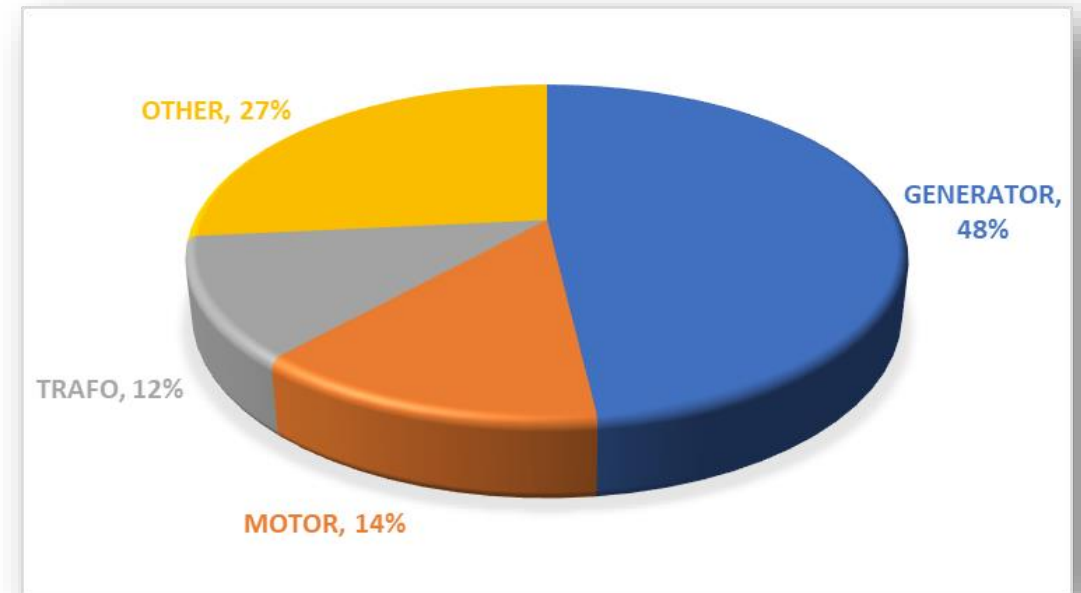
Notices and disclaimers

- The word *personal* in title sound selfish, but its purpose is to emphasize the digital library is for *personal use only*, avoiding copyright infringement
- A copyright reserves its owner legal rights to reproduce or distribute a material
- Licenses can be applied to copyrighted material to allow certain material uses.



Introduction

- In the past technicians or engineers used to keep cabinets of technical documents
- Hardcopies occupied office space and searching was based on human memory
- About 25 years ago I decided to convert my documents to paperless digital library
- I made sure that every document added to the library afterwards was digital only
- My personal digital library is focused on *electrical machines*, mostly *rotating* ones.



Preservation of history knowledge

- “An OEM may solve problems with an elegant simple design, whereas other OEM may use complicate (almost Rube Goldberg) design”
- “The inability to pass on the knowledge to the younger design and service engineers, repeatedly led to ‘reinventing old problems’”.

[From Clyde Maughan’s *papers*]



Cartoons of simple tasks performed in indirect, overly complicated ways

Features of digital library

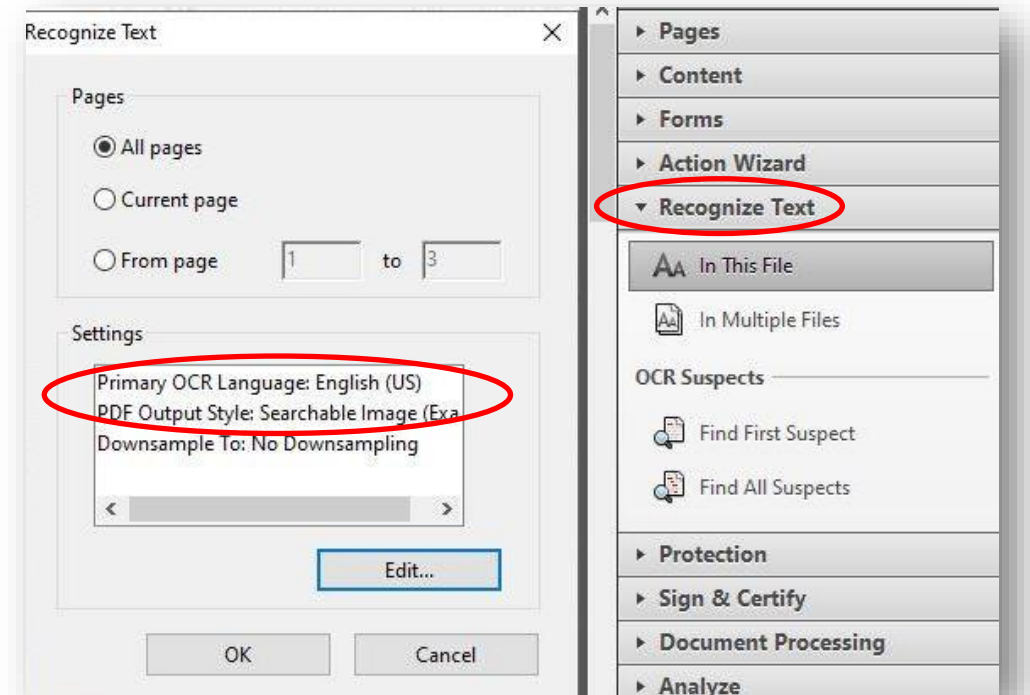
- Advantages of digital libraries:
 - Information retrieval: performing fast search among the entire collection
 - Storage space: huge information in personal computer or USB flash drive
 - Access availability: around the clock, from any location.
- Basic tools to create a digital library:
 - Scanner and image converter into searchable text
 - Searching software among the digital library folders
 - Sufficient hard disk space and backup tools.
- Initially, these very basic tools were not all available in my company, so I had to look by myself for alternatives.



This presentation deals only with Windows (not Apple) OS and related applications. It includes some examples of software I use, that may be not the last or best version.

Scanning and OCR

- A typical tool to convert images to pdf is Adobe Acrobat Standard or Professional *writer* software
- Acrobat writer includes *OCR* (Optical Character Recognition) function that add to scanned image a searchable text layer
- *OCR* can be performed if scanning was done at a resolution of 72 to 3000 dpi. Usually, 300 to 600 dpi is best suited for conversion and reasonable sized files.



Documents searching

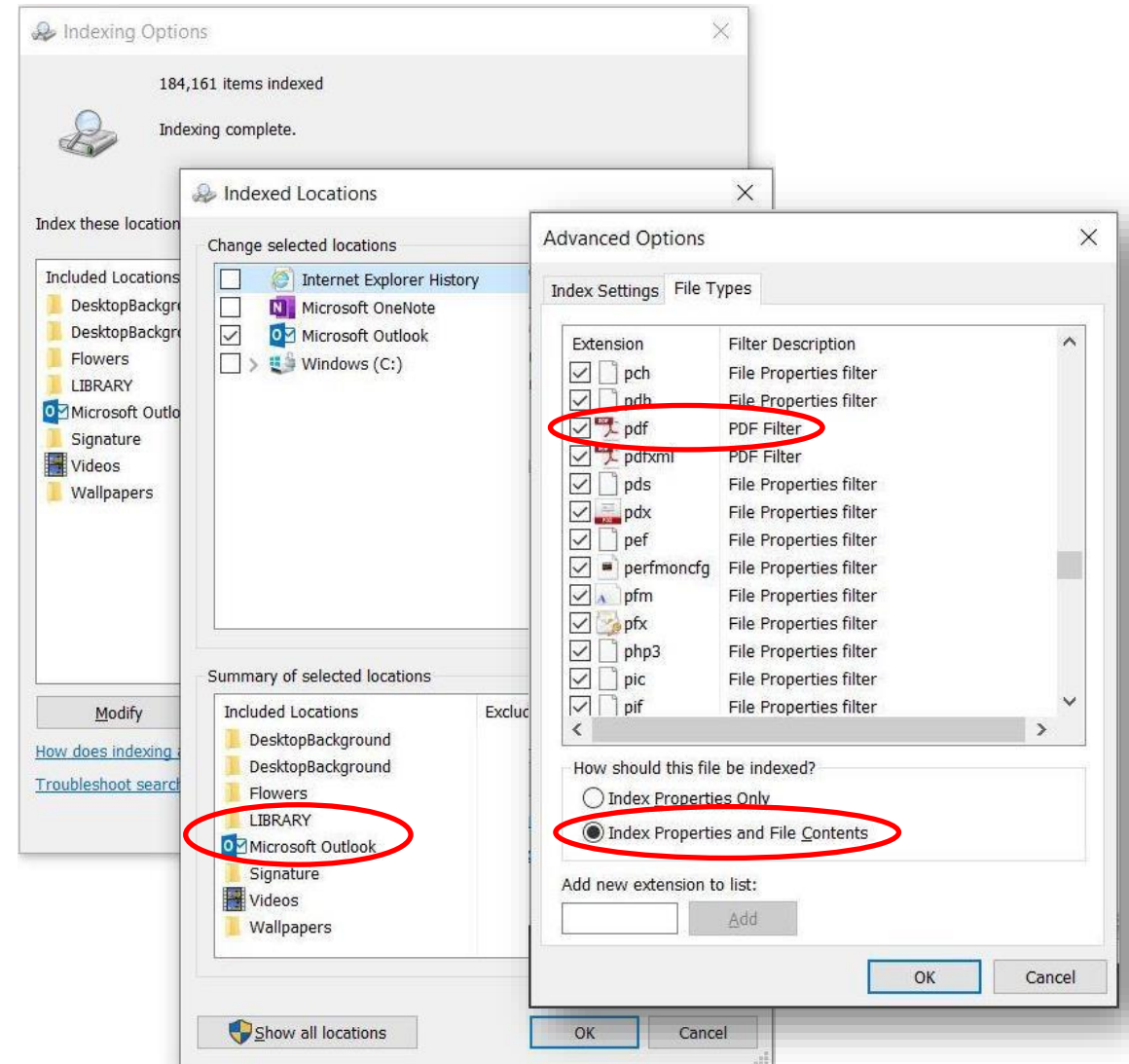
- Firstly, I created in Excel a tree structure (that I maintain to this day) including document ID number, title, source, equipment, aspect, language, year, author
- Excel sheets for papers, books, standards can be searched separately or within entire workbook. Documents respectively arranged and searchable in folders.

	A	B	C	D	E	F	G	H
19	19	WHAT NO LOAD RUNNING TESTS CAN AND CANNOT REVEAL	ELAPP	MOTOR	DIAGN	E	1999	NAILEN
26	26	GENERATOR UPGRADES AND REWINDS GER 3707D	GE	GEN	MAINT	E	1996	HALPERN
66	66	DIAGNOSTIC TESTING OF GENERATOR INSULATION WITHOUT SERVICE INTERRUPTION	CIGRE	GEN	DIAGN	E	1980	STONE
68	68	WHAT'S THE RIGHT HORSEPOWER	ELAPP	MOTOR	CHARACT	E	1999	NAILEN
153	153	THE USE OF PARTIAL DISCHARGE MEASUREMENTS TO ASSESS THE CONDITION OF ROTATING MACHINE INSULATION	IEEE	ROTMACH	INSUL	E	1996	STONE
215	215	PREVENTATIVE MAINTENANCE OF TURBINE GENERATOR STATOR WINDINGS	IEEE	GEN	MAINT	E	1992	MAUGHAN
406	406	USING PARTIAL DISCHARGE MEASUREMENT TECHNOLOGY TO IMPLEMENT PREDICTIVE MAINTENANCE IN HIGH VOLTAGE MOTOR AND GENERATOR STATO	IEEE	ROTMACH	DIAGN	E	1997	STONE
418	418	CAN FIELD TESTS PROVE MOTOR EFFICIENCY	IEEE	MOTOR	DIAGN	E	1988	NAILEN
618	618	HIGH POTENTIAL TESTING OF LARGE TURBINE GENERATOR STATOR INSULATION	GE	GEN	DIAGN	E	1970	MAUGHAN
1026	1026	CALCULATION OF NEGATIVE SEQUENCE LOSSES AND NEGATIVE SEQUENCE RESISTANCE OF TURBOGENERATORS	IEEE	GEN	CHARACT	E	1975	CANAY
1114	1114	INTERTURN SHORT CIRCUIT DETECTOR FOR TURBINE GENERATOR ROTOR WINDINGS GER 2668	GE	GEN	DIAGN	E	1970	ALBRIGHT
1291	1291	ROTOR SHORTED TURNS DETECTION AND DIAGNOSTICS	EPRI	GEN	DIAGN	E	2003	KLEMPNER
1561	1561	DEVELOPMENT OF A TECHNIQUE FOR ON LINE DETECTION OF SHORTS IN FIELD WINDINGS OF TURBINE GENERATOR ROTORS CIRCUIT DESIGN AND TESTI	IEEE	GEN	DIAGN	E	2000	KERSZENBAL
2154	2154	PARTIAL DISCHARGE A VALUABLE STATOR WINDING EVALUATION TOOL	IEEE	GEN	DIAGN	E	2006	MAUGHAN
2174	2174	IS THERE A TRUE CLASS H INSULATION SYSTEM YET	IRIS	ROTMACH	CHARACT	E	2006	STONE
2201	2201	DELAYED CURRENT ZEROS DUE TO OUT OF PHASE SYNCHRONIZING	IEEE	GEN	OPER	E	1998	CANAY
2271	2271	PROCURING STATOR COILS FROM A QUALITY VENDOR	IEEE	ROTMACH	MAINT	E	2001	MOORE
2340	2340	EXPERIENCE OF A FLUX PROBE USER	IRIS	GEN	DIAGN	E	2007	ILIE
2371	2371	GENERATOR STATOR BAR GROUND FAULT AT ISRAEL ELECTRIC IEC _o	EPRI	GEN	RELIAB	E	2001	KREISELMAN
3270	3270	EXPERIENCE AND BENEFIT OF USING EL CID FOR TURBINE GENERATORS	EPRI	GEN	DIAGN	E	1995	KLEMPNER
3667	3667	GENERATOR SPARE CONDUCTOR BARS	IRIS	GEN	MAINT	E	2008	ILIE
3694	3694	CONCEPTS OF SYNCHRONOUS MACHINE STABILITY AS AFFECTED BY EXCITATION CONTROL	IEEE	GEN	STABIL	E	1969	CONCORDIA
4188	4188	GENERATOR ROTOR POLE CROSSOVER REPLACEMENTS	DOBLE	GEN	MAINT	E	2009	MOORE
4224	4224	VIBRATION DETECTION INSTRUMENTATION FOR TURBINE GENERATOR STATOR ENDWINDINGS	IEEE	GEN	DIAGN	E	2009	MAUGHAN
4289	4289	ROOT CAUSE EVALUATION OF A GENERATOR ROTOR CRACK	EPRI	GEN	MECHAN	E	2009	KILPATRICK
5490	5490	TURBINE GENERATORS UP TO 550 MVA WITH GLOBAL VACUUM IMPREGNATED STATOR WINDINGS	SIEMENS	GEN	CHARACT	E	2000	WEIDNER
5498	5498	TURBO GENERATOR HIGH POTENTIAL TESTING	EPRI	GEN	DIAGN	E	2011	ILIE
5774	5774	VIBRATION DETECTION INSTRUMENTATION FOR STATOR END WINDINGS	DOBLE	GEN	DIAGN	E	2012	MAUGHAN
5781	5781	BEFORE YOU BUY THAT MOTOR A SECOND LOOK	ELAPP	MOTOR	CHARACT	E	2012	NAILEN
5784	5784	WHY DO SO FEW PLANTS PERFORM ROTOR HIPOOT TESTING ADVANCED ENDWINDING VIBRATION MONITORING SYSTEM	IRIS	GEN	DIAGN	E	2012	STONE
6800	6800	GENERATOR STATOR WINDING VIBRATION AND RESONANCE	EPRI	GEN	DIAGN	E	2015	MOORE
6813	6813	LESSONS LEARNED FROM GENERATOR FAILURES	EPRI	GEN	MAINT	E	2015	HALPERN
7063	7063	INDUSTRY EXPERIENCE FORGING CRACK ISSUE PRESENTATION	GUG	GEN	RELIAB	E	2015	KILPATRICK
7067	7067	WATER COOLED STATOR WINDINGS COPPER OXIDE ISSUES	GUG	GEN	COOL	E	2015	MAUGHAN
7769	7769	IN SERVICE GENERATOR STATOR AND ROTOR TESTING SOLUTIONS	DOBLE	GEN	DIAGN	E	2017	ALBRIGHT
7887	7887	INFLUENCE OF GRID CODES AND FLEXIBLE OPERATION ON EXISTING GENERATORS 2017	IEEE	GEN	CHARACT	E	2017	LAU
8168	8168	THERMOSET STATOR BAR INSULATION SYSTEMS DOBLE	DOBLE	GEN	INSUL	E	2018	MAUGHAN
8186	8186	18-18 RETAINING RING INDICATIONS	IGTC	GEN	MECHAN	E	2018	KILPATRICK
8208	8208	ELEVATED FREQUENCY LOOP TESTING	EPRI	GEN	DIAGN	E	2018	LAU
8219	8219	EPRI SUMMER 2018 STEAM TURBINE GENERATOR WORKSHOP WELCOME AND APP	EPRI	GEN	CHARACT	E	2018	MOORE
8706	8706	EXPERIENCE WITH AN ADAPTIVE EXPERT MONITORING SYSTEM FOR TURBINE GENERATOR MONITORING	CIGRE	GEN	DIAGN	E	1992	KLEMPNER
8715	8715	SURGE TEST BASED IDENTIFICATION OF STATOR INSULATION COMPONENT WITH PD ACTIVITY FOR LOW VOLTAGE AC MOTORS	IEEE	MOTOR	DIAGN	E	2019	STONE
9392	9392	METHODS TO ESTABLISH TURBO GENERATOR OUTAGE INTERVALS	IRIS	GEN	MAINT	E	2022	ILIE
9400	9400	EPRI 50 ANNIVERSARY EPRI GENERATOR RESEARCH RECENT IN PROGRESS AND FUTURE PLANNED	IRIS	GEN	CHARACT	E	2022	MOORE
9500	9500	THE GREAT MOTOR EFFICIENCY RACE	ELAPP	MOTOR	CHARACT	E	2021	NAILEN
9514	9514							
9515	NO	TITLE	ORIGIN	EQUIPMENT	ASPECT	LNG	YEAR	AUTHOR



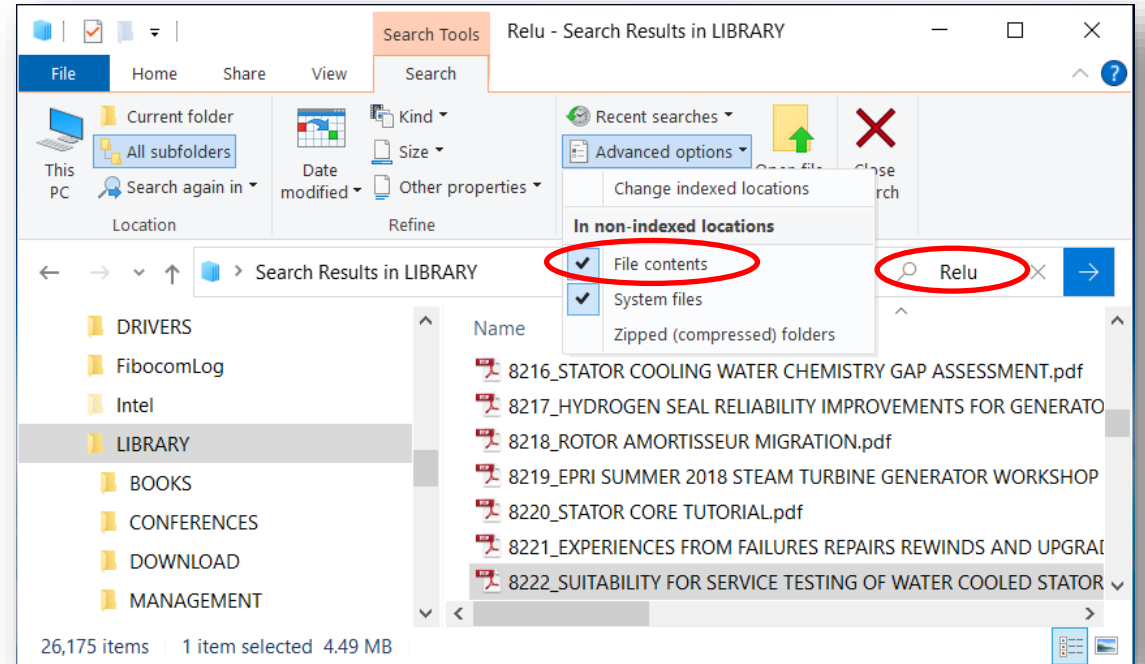
Documents searching (continued)

- In a further stage, I looked for *desktop search* programs, preferable free, for unlimited number of files
- A mandatory requirement was the capability to search text inside common files like pdf and Microsoft Office files
- Initially I used Copernic or Google Desktop Search. Later, built-in search function in Windows - *Indexing Service*
- Some fine-tuning may be needed in *Indexing Options* (locations, file types).



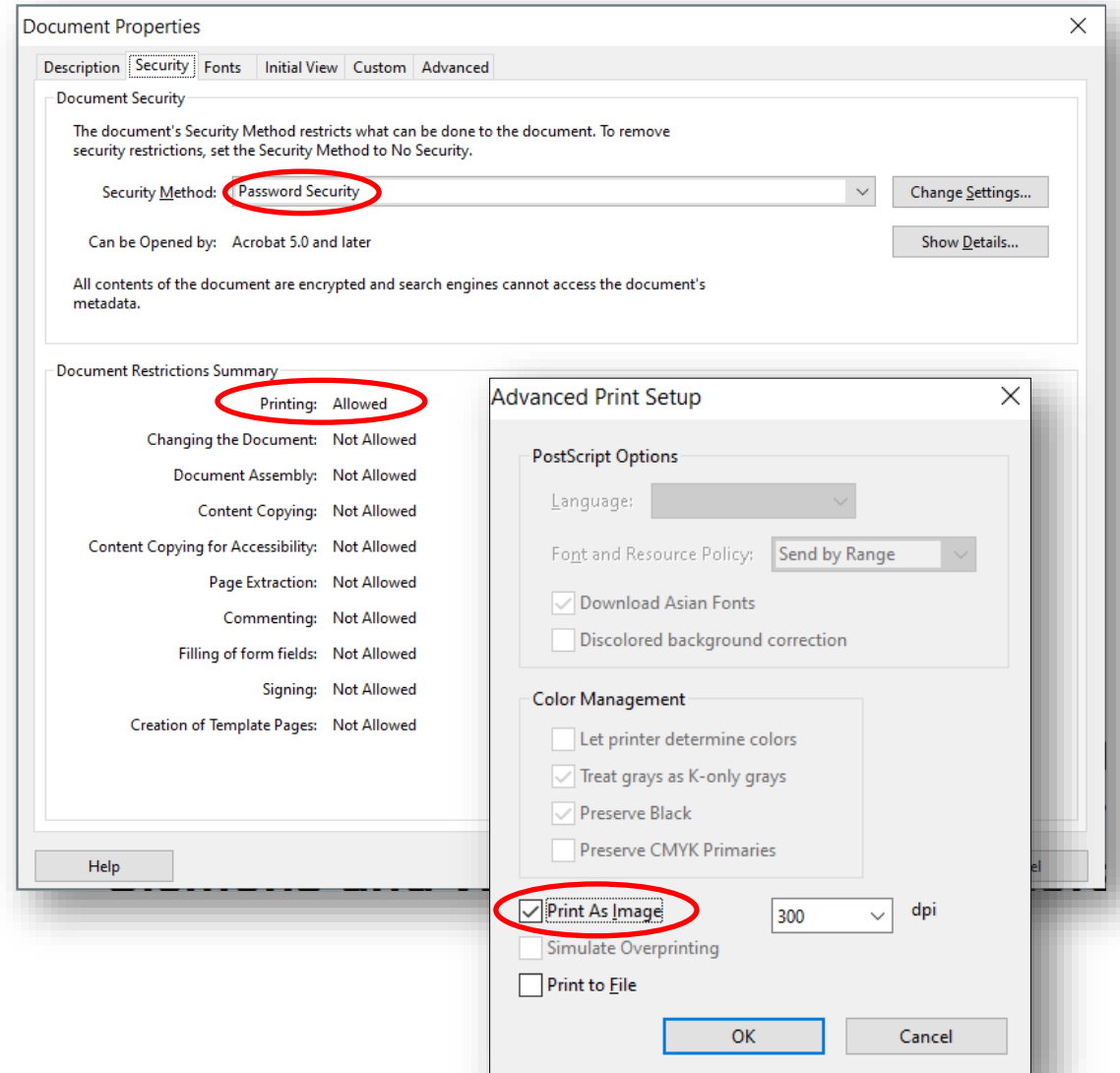
Documents searching (continued)

- In Windows Explorer, the search is done from the *Search Pane* of any folder
- When typing a search term in *Search Pane*, the ribbon changes to *Search Tools* and *Advanced Options* appear
- For instance, *File Contents* can be checked, however such search will take hours if the folder has not been indexed.



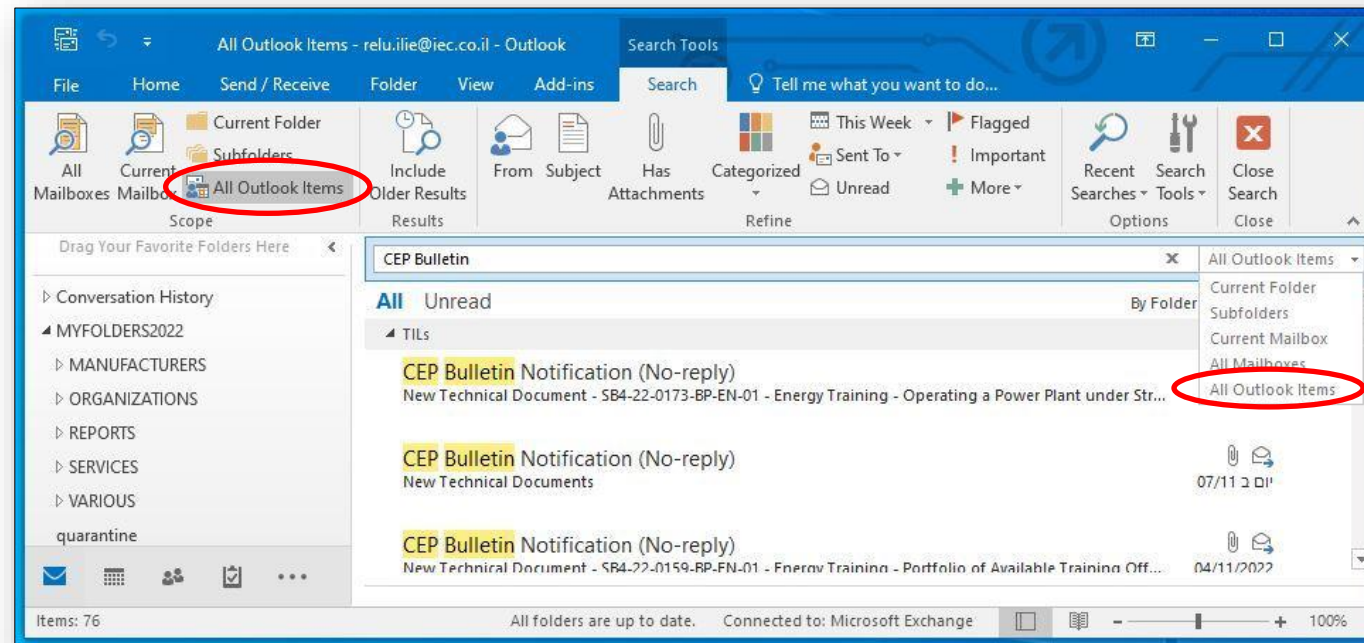
Documents searching (continued)

- If not able to search within file (Ctrl+F in Acrobat), probably *Password Security* is activated - search cannot be performed
- Look in *File / Properties / Security* to see the various existing restrictions
- The solution may be to try to obtain from the author an unprotected file version
- If the file is protected but printing is allowed, it may be possible to *Print as Image* into another pdf and perform *OCR*. This may remove the protection.



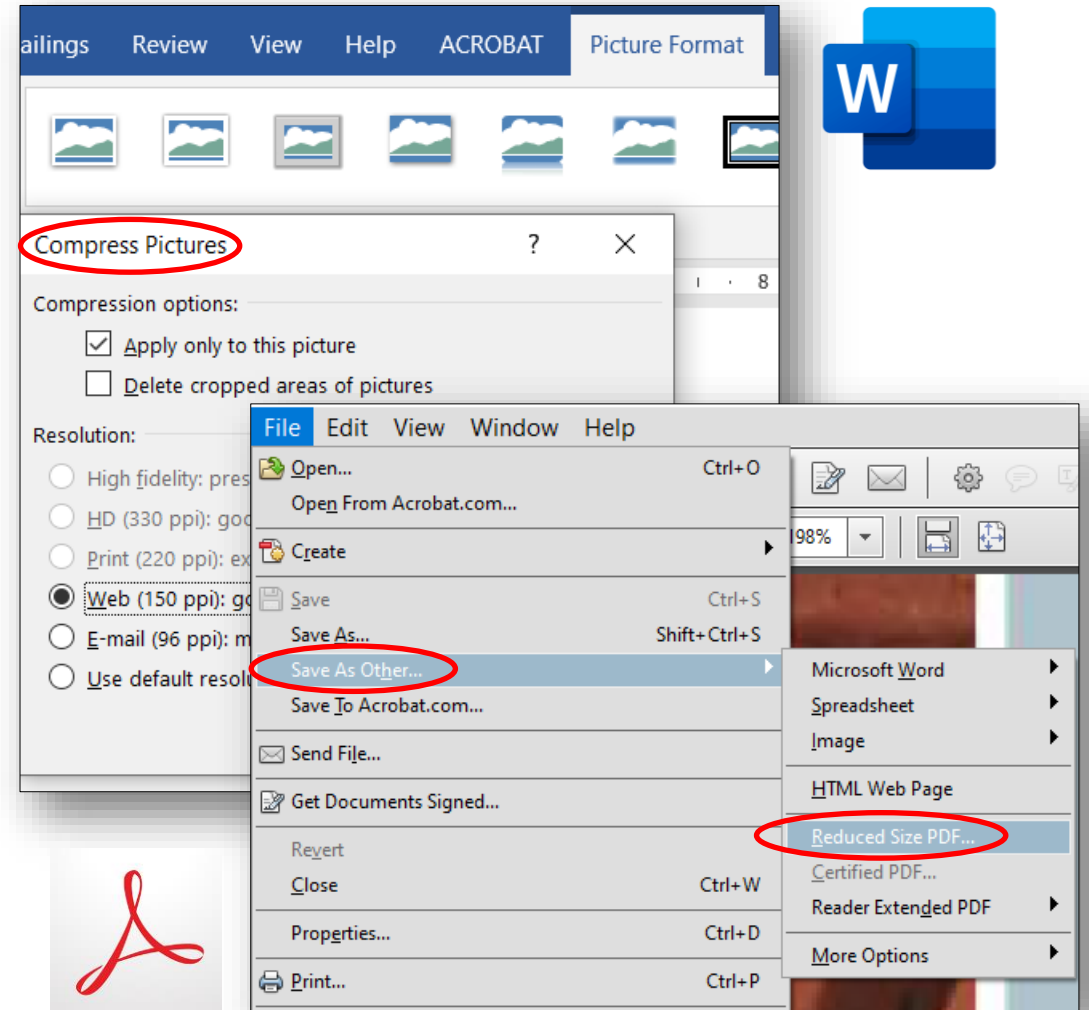
Emails searching

- Outlook also needs indexing to allow an *Instant Search* instead of *slow search*
- The emails indexing takes place when computer is *idle* while Outlook is running
- Write in top *Search Bar* and choose mailboxes; ribbon changes to *Search Tools*
- Default search is in *Current Mailbox*, but most inclusive is in *All Outlook Items*.



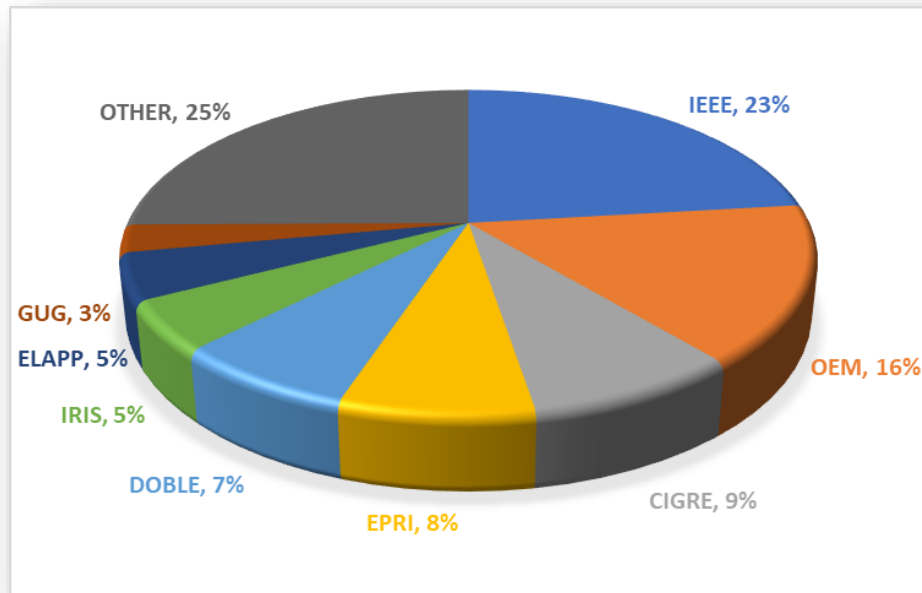
Memory space and backup

- Movies tend to be extremely large; there are applications that reduce video size
- Detailed and sharper photos are large files; simple apps may compress them
- Word or PowerPoint can *Compress Pictures* (available from *Format* ribbon)
- Converting Microsoft Office files to pdf leads to a great reduction in their size
- Some pdf files can be unnecessary large; the solution is *Save as Reduced Size pdf*
- A digital library also needs backup tools. One good example is freefilesync.org.



Where to search

- Google, Wikipedia, ChatGPT are not yet well-suited for deep engineering quests
- “Libraries are not a thing of the past” [Jane Hutt (†), *An Approach to Performing Time-Efficient Generator Literature Searches*, GUG conference 2022].
- There are many sources. The first obvious one: internal reports, procedures, etc.



Where to search (continued)

- IEEE (papers, standards, books): can be accessed from ieeexplore.ieee.org
- OEMs (GE, Siemens, etc.): available on their sites or presented at conferences
- CIGRÉ (A1 Rotating Electrical Machines): technical brochures from e-cigre.org
- EPRI (Program 65, newer 220 and Generator Workshop at TGUG): epri.com
- DOBLE (International Conference): portal.doble.com or community.mydoble.com
- IRIS Power (Rotating Machine Conference): papers at irispower.com/learning
- ELECTRICAL APPARATUS: monthly magazine mainly dedicated to motors
- IEC (TC2 Rotating Machinery): standards from webstore.iec.ch or global.ihs.com
- GUG and Combined Cycle Journal: powerusers.org and ccj-online.com
- IGTC (discussion forums, Round Table): generatortechnicalforum.org
- INTERNET ARCHIVE (old classic books of electrical machines): archive.org.

What to search

- It is preferable to use keywords approved by standardization organizations:
 - IEEE Standards Dictionary ieeexplore.ieee.org/browse/standards/dictionary
 - IEC approved terms in several languages (free of charge): electropedia.org.

The screenshot shows the IEEE Xplore Standards Dictionary interface. At the top, there is a navigation bar with 'IEEE Xplore' logo, 'Browse', 'My Settings', and 'Help' menus. A search bar is present with a dropdown menu set to 'All' and a search button. Below the search bar, there are tabs for 'Browse Standards' with sub-tabs: 'By Collection', 'By Number', 'By Topic', 'By ICS Code', 'Reading Room', 'IEEE GET Program™', and 'IEEE Standards Dictionary'. A 'Keyword Search' field is visible. Below this, there are 'Browse Standards' links for 'Active Standards' and 'All Standards'. The main content area shows search results for 'insulation resistance', listing four entries with expandable details. A sidebar on the right promotes 'Publish Open Access with IEEE' with benefits like 'Maximize visibility via IEEE Xplore', 'Rapid decisions', 'Rigorous peer-review', and 'Mandate-compliant'.

The screenshot shows the Electropedia website interface. At the top, there is the IEC logo and the text 'International Electrotechnical Commission'. Below this, the title 'Electropedia: The World's Online Electrotechnical Vocabulary' is displayed. A search form includes a 'Query:' field, a 'Language:' dropdown menu set to 'English', and a 'Subject area:' dropdown menu set to 'All'. There are 'Search' and 'Clear' buttons, and a checkbox for 'Search also in definitions'. Below the search form, there is a note: 'Numbers correspond to table below'. The main content area contains two paragraphs of text. The first paragraph states that Electropedia is produced by the IEC, the world's leading organization that prepares and publishes International Standards for all electrical, electronic and related technologies – collectively known as "electrotechnology". It also mentions that Electropedia (also known as the "IEV Online") contains all the terms and definitions in the International Electrotechnical Vocabulary or IEV which is published also as a set of publications in the IEC 60050 series that can be ordered separately from the IEC webstore. The second paragraph states that Electropedia is the world's most comprehensive online terminology database on "electrotechnology", containing more than 22 000 terminological entries in English and French organized by subject area, with equivalent terms in various other languages: Arabic, Chinese, Czech, Dutch (Belgian), Finnish, German, Italian, Japanese, Korean, Mongolian, Norwegian (Bokmål and Nynorsk), Polish, Portuguese, Russian, Serbian, Slovenian, Spanish and Swedish (coverage varies by subject area). The final paragraph states that the world's experts in electrotechnical terminology work to produce Electropedia under the responsibility of IEC Technical Committee 1 (Terminology), one of the 204 IEC Technical Committees and Subcommittees.

How to search

- Broad engineering bibliography was published in other languages excepting English (German, Russian, French...) - possible today using Google Translate
- Even English may use various synonyms: generator (alternator or synchronous machine), high potential (overpotential or hipot), flux probe (airgap search coil)
- Big OEMs developed during the years slightly different technical terms (for instance GE term end-shield versus Westinghouse bearing-bracket)
- British English terms may differ than the American English ones: turning-gear (barring-gear), retaining rings (end caps), bar strands (sub-conductors), etc.
- To solve such issues and refine Windows search you can use: capitalized Boolean operators (AND, OR); quotation marks for searching exact phrase; minus in front of a term to avoid it in results. Order of words may matter.

Conclusions

- This presentation explains in brief my prolonged efforts to create a personal technical digital library, mainly related to electrical machines. My digital library includes today thousands of items of various types.
- My experience indicates a significant success. In the day-to-day work, quick answers to problems can be found. When writing a paper, I always start with a quick preliminary list of good and comprehensive references.
- I am able to help my colleagues in performing references searches on specific topics. I cannot supply document copies (for copyright reasons); however, a good tailor-made references list will save time and money.
- The project required minimal software purchases (actually only Adobe Acrobat), a small - but continuous - investment of time to maintain the digital library, and especially, A LOT OF GOODWILL.

Thank you!

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