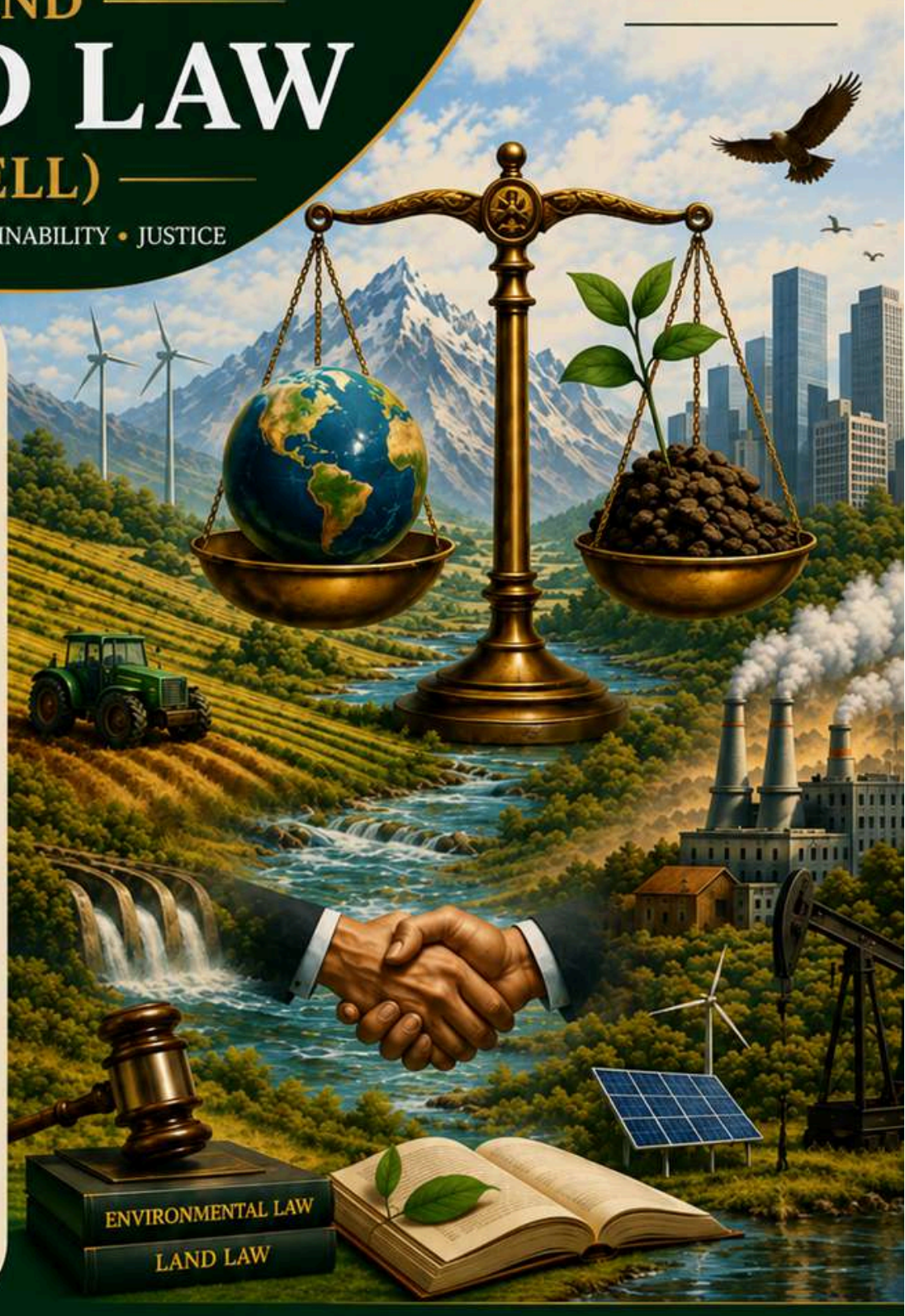
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Original research article

BUG‘DOY DONI NAMLIGINI ADAPTIV KOMPENSATSIYALOVCHI KO‘P ZONALI SIG‘IMLI DATCHIK BILAN ANIQLASH

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TEZIS MA’LUMOTI

Kalit so’zlar:
bug‘doy doni,
namlik,
sig‘imli datchik,
adaptiv kompensatsiya,
hajmiy zichlik,
harorat,
LMS algoritmi.

A N N O T A T S I Y A

Tezisda bug‘doy doni namligini tezkor va buzmasdan aniqlash uchun adaptiv ko‘p zonali sig‘imli datchikni ishlab chiqish bo‘yicha tadqiqot yondashuvi taklif etiladi. Datchikning ikkita o‘lchash zonasi don qatlamining notekis joylashishini kuzatadi, materialdan ajratilgan tayanch sig‘im kanali esa o‘lchash elektronikasidagi siljishlarni qayd etadi. Harorat va hajmiy zichlik alohida o‘lchanib, sig‘im signallari bilan birgalikda adaptiv kalibrlash modeliga uzatiladi. Namlikning etalon qiymatlari ISO 712-1:2024 talablariga muvofiq aniqlanishi rejalashtiriladi. Taklifning samaradorligi statik sig‘im kalibrlashi bilan adaptiv tuzatish modelining mustaqil namuna to‘plamidagi xatolarini taqqoslash orqali baholanadi. Hozircha bug‘doy namligi bo‘yicha tajriba natijalari mavjud emas; shu sababli tezisda sonli natijalar keltirilmagan.

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DETERMINATION OF WHEAT GRAIN MOISTURE WITH ADAPTIVE COMPENSATING MULTI-ZONE CAPACITIVE SENSOR

THESIS INFO

Keywords:
wheat grain,
moisture content,
capacitive sensor,
adaptive compensation,
bulk density,
temperature,
LMS algorithm..

A B S T R A C T

The thesis proposes a research approach to the development of an adaptive multi-zone capacitive sensor for the rapid and non-destructive determination of wheat grain moisture. The two measurement zones of the sensor monitor the uneven distribution of the grain layer, while the supporting capacitance channel separated from the material records displacements in the measuring electronics. Temperature and bulk density are measured separately and transmitted to the adaptive calibration model along with capacitance signals. It is planned to determine the reference humidity values in accordance with the requirements of ISO 712-1:2024. The effectiveness of the proposal is evaluated by comparing the errors of the adaptive correction model with static capacity calibration in an independent sample set. Experimental data on wheat moisture content are currently unavailable; therefore, numerical results are not provided in the thesis.

ОПРЕДЕЛЕНИЕ ВЛАЖНОСТИ ЗЕРНА ПШЕНИЦЫ С ПОМОЩЬЮ АДАПТИВНОГО КОМПЕНСАЦИОННОГО МНОГОЗОННОГО ЕМКОСТНОГО ДАТЧИКА

ИНФОРМАЦИЯ ТЕЗИС

Ключевые слова:
зерно пшеницы,
влажность,
ёмкостный датчик,
адаптивная компенсация,
насыпная плотность,
температура,
алгоритм LMS..

А Н Н О Т А Т С И Я

В тезисе предлагается исследовательский подход к разработке адаптивного многозонного емкостного датчика для быстрого и неразрушающего определения влажности зерна пшеницы. Две измерительные зоны датчика отслеживают неравномерное расположение зернового слоя, а канал опорной емкости, отделенный от материала, фиксирует смещения в измерительной электронике. Температура и объемная плотность измеряются отдельно и передаются в модель адаптивной калибровки вместе с емкостными сигналами. Планируется, что эталонные значения влажности будут определены в соответствии с требованиями ISO 712-1:2024. Эффективность предложения оценивается путем сравнения ошибок модели адаптивного исправления с калибровкой статической емкости в независимой выборке. Результаты экспериментов по влажности пшеницы пока отсутствуют; поэтому в тезисе не приведены численные результаты.

KIRISH

Ushbu tezisda yangi yo‘nalish sifatida bug‘doy namligini etalon usul bilan taqqoslash va donning hajmiy zichligi hamda harorat o‘zgarishlari ta’sirini tajribada baholash ko‘zda tutiladi. Don namligi saqlash, quritish va qayta ishlash jarayonlarida muhim sifat ko‘rsatkichidir. Etalon quritish usuli ishonchli natija beradi, biroq namlikni tezkor nazorat qilish uchun elektr xossalariga asoslangan usullar ham qo‘llanadi. Bug‘doy donining dielektrik xossalari namlik bilan birga harorat, nav va namunaning hajmiy zichligiga ham bog‘liq. Avvalgi tadqiqotlarda sig‘im va dielektrik ko‘rsatkichlardan foydalanilgan, ayrim ishlar zichlik ta’sirini kamaytirish uchun bir nechta chastotadagi ma’lumotlarni birgalikda tahlil qilgan. Demak, yangi ishda faqat sig‘im o‘zgarishini qayd etish emas, balki o‘lchash sharoitlari o‘zgarishining ta’sirini alohida baholash zarur.

TADQIQOT MAQSADI VA TAKLIF ETILAYOTGAN YECHIM

Tadqiqot maqsadi — bug‘doy doni namligini aniqlash uchun harorat va donning hajmiy zichligi o‘zgarishlariga adaptiv tuzatish kiritadigan ko‘p zonali sig‘imli datchikni ishlab chiqish va tajribada baholash.

Datchikda ikkita mustaqil o‘lchash zonasi va don bilan kontaktda bo‘lmagan tayanch kondensator ko‘zda tutiladi. O‘lchash zonalarining signallari namuna qatlamidagi notekis to‘lish va joylashish holatini baholashga yordam beradi. Tayanch kanal esa elektronika va parazit sig‘imlar bilan bog‘liq siljishlarni kuzatish uchun ishlatiladi. Don harorati va hajmiy zichligi yordamchi kirish ko‘rsatkichlari sifatida qayd etiladi. Moslashuv algoritmi etalon namlik bilan bog‘langan kalibrlash bosqichida o‘qitilib, keyin alohida ajratilgan namunalarda tekshiriladi.

TADQIQOT USULI

Tajriba uchun bug‘doy namunalarining namlik darajalari tayyorlanib, ularning etalon namligi ISO 712-1:2024 dagi don mahsulotlari uchun reference method asosida aniqlanadi. Har bir namuna uchun sig‘im, harorat, hajmiy zichlik, qo‘zg‘atish chastotasi va qayta to‘ldirish sikli qayd etiladi. Dastlabki ishchi reja namlikning taxminan 9–21% oralig‘ini, 10, 25 va 40 °C harorat nuqtalarini hamda uch xil zichlik holatini qamrab oladi; yakuniy darajalar laboratoriya imkoniyatiga ko‘ra belgilanadi. O‘lchashlar statik sig‘im kalibrlashi, ko‘p omilli regressiya va adaptiv LMS qoldiq tuzatish modeli uchun taqqoslanadi. Ma’lumotlar takroriy o‘lchovlar o‘rtasida aralashib ketmasligi uchun o‘qitish va tekshirish to‘plamlari alohida namunalar yoki partiyalar bo‘yicha ajratiladi.

KUTILAYOTGAN ILMIY VA AMALIY NATIJA

Tadqiqot natijasida bug‘doy namligini sig‘im orqali aniqlashda harorat, zichlik va datchik siljishi ta’sirlarini alohida hisobga oluvchi o‘lchash hamda kalibrlash metodikasi ishlab chiqilishi kutiladi. Datchikning aniqligi MAE, RMSE, sistematik xatolik, takrorlanuvchanlik va javob vaqti bilan baholanadi. Adaptiv modelning afzalligi faqat mustaqil sinov natijalari statik kalibrlash bilan taqqoslangandan keyin miqdoriy xulosa qilinadi.

XULOSA

Bug‘doy doni namligini aniqlash uchun taklif etilayotgan ko‘p zonali sig‘imli datchik o‘lchash signali bilan birga harorat, hajmiy zichlik va tayanch kanal ma’lumotlarini hisobga olishga mo‘ljallangan. Mazkur yondashuvni asoslash uchun ISO 712-1:2024 bo‘yicha etalon namlik qiymatlari bilan taqqoslangan takroriy laboratoriya tajribalari zarur. O‘lchovlar bajarilmaguncha aniqlikni oshirish yoki shovqinni kamaytirish bo‘yicha sonli da’volar berilmaydi.

FOYDALANILGAN ADABIYOTLAR RO’YXATI

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